THE

TUTOR'S ASSISTANT;

BEING A

COMPENDIUM OF ARITHMETIC,

AND

A COMPLETE QUESTION-BOOK.

CONTAINING,

I. ARITHMETIC in WHOLE NUMBERS; being a brief Explanation of all its Rules, in a New and more conciſe Method than any hitherto publiſhed; with an Application to each Rule, conſiſting of a large Variety of Queſtions in real Buſineſs, with their Anſwers annexed.

II. VULGAR FRACTIONS, which are treated with a great deal of Plainneſs and Perſpicuity.

III. DECIMALS, with the Extraction of the Square, Cube, and Biquadrate Roots, after a very plain and familiar Manner; in which are ſet down Rules for the eaſy Calculation of Intereſt, Annuities and Penſions in Arrear, the preſent Worth of Annuities, &c. either by Simple or Compound Intereſt.

IV. DUODECIMALS, or MULTIPLICATION of Feet and Inches, with Examples applied to meaſuring and working by Multiplication, Practice, and Decimals.

V. The MENSURATION of CIRCLES.

VI. A COLLECTION of QUESTIONS, ſet down promiſcuouſly, for the greater Trial of the foregoing Rules.

To which are added,

A new and very ſhort Method of extracting the CUBE-ROOT, *and a* GENERAL TABLE *for the ready calculating the* INTEREST *of any Sum of Money, at any Rate per Cent. likewiſe* Rents, Salaries, &c.

The whole being adapted either as a QUESTION-BOOK for the Uſe of Schools, or as a REMEMBRANCER and INSTRUCTOR to ſuch as have ſome Knowledge therein.

This Work having been peruſed by ſeveral eminent Mathematicians and Accomptants, is recommended as the beſt Compendium hitherto publiſhed for the Uſe of Schools, or for private Perſons.

By FRANCIS WALKINGAME.

A NEW EDITION,

CORRECTED BY AN EMINENT MATHEMATICIAN.

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181. g. 164

ADVERTISEMENT.

THE many Editions lately printed of this Work having occaſioned a Multiplicity of Errors in ſeveral of them, the preſent Publiſhers have engaged an eminent Mathematician carefully to work every ſum anew; the Public may therefore depend on the Correctneſs of this Edition.

JANUARY 1, 1796.

PREFACE.

THE Public, no doubt, will be ſurpriſed to find there is another attempt made to publiſh a book of ARITHMETIC, when there are ſuch numbers already extant on the ſame ſubject, and ſeveral of them that have ſo lately made their appearance in the world; but I flatter myſelf that the following reaſons which induced me to compile it, the method, and the conciſeneſs of the rules, which are laid down in ſo plain and familiar a manner, will have ſome weight towards its having a favourable reception.

Having ſome time ago drawn up a ſet of rules and proper queſtions, with their anſwers annexed, for the uſe of my own ſchool, and divided them into ſeveral books, as well for more eaſe to myſelf, as the readier improvement of my ſcholars, I found them, by experience, of infinite uſe; for when a maſter takes upon him that laborious (though unneceſſary) method of writing out the rules and queſtions in the children's books, he muſt either be toiling and ſlaving himſelf, after the fatigue of the ſchool is over, to get ready the books for the next day, or elſe he muſt loſe that time which would be much better ſpent in inſtructing and opening the minds of his pupils. There was, however, ſtill an inconvenience which hindred them from giving me the ſatisfaction I at firſt expected, *i. e.* where there are ſeveral boys in a claſs, ſome one or other muſt wait till the boy who firſt has the book finiſhes the writing out thoſe rules or queſtions he wants, which detains the others from making that progreſs they otherwiſe might, had they a proper book of rules and examples for each; to remedy which, I was prompted to compile one, in order to have it printed, that it might not only be of uſe to my own ſchool, but to ſuch others as would have their ſcholars make a quick progreſs. It will alſo be of great uſe to ſuch gentlemen as have acquired ſome knowledge of numbers at ſchool, to make them the more perfect; likewiſe to ſuch as have completed themſelves therein, it will prove, after an impartial peruſal, on account of its great variety and brevity, a moſt agreeable and entertaining exerciſe-book. I ſhall not preſume to ſay any thing more in favour of this work, but beg leave to refer the unprejudiced reader to the remark of a certain author*, concerning compoſitions of this nature. His words are as follow:

“ And now, after all, it is poſſible that ſome who “ like beſt to tread the old beaten path, and to ſweat “ at their buſineſs, when they may do it with plea- “ ſure, may ſtart an objection againſt the uſe of this “ well-intended ASSISTANT, becauſe the courſe of “ ARITHMETIC is always the ſame; and therefore “ ſay, *That ſome boys, lazily inclined, when they ſee* “ *another at work upon the ſame queſtion, will be apt* “ *to make his operation paſs for their own.* But theſe “ little forgeries are ſoon detected by the diligence “ of the TUTOR: Therefore, as different queſtions “ to different boys do not in the leaſt promote their “ improvement, ſo neither do the queſtions hinder “ it. Neither is it in the power of any maſter, “ (in the courſe of his buſineſs) how full of ſpirits “ ſoever he be, to frame new queſtions at pleaſure, “ in any rule; but the ſame queſtion will frequently “ occur in the ſame rule, notwithſtanding his greateſt “ care and ſkill to the contrary.

“ It may alſo be further objected, *That to* “ *teach by a printed book is an argument of ignorance* “ *and incapacity;* which is no leſs trifling than the “ former. He, indeed, (if any ſuch there be) who

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* Mr. THOMAS DILWORTH.

" is afraid his ſcholars will improve too faſt, will " undoubtedly decry this method: But that maſter's " ignorance can never be brought in queſtion who " can begin and end it readily; and, moſt cer- " tainly, that ſcholar's non-improvement can be as " little queſtioned, who makes a much greater pro- " greſs by this than by the common method.

To enter into a long detail of every rule would tire the reader, and ſwell the preface to an unuſual length; I ſhall, therefore, only give a general idea of the method of proceeding, and leave the reſt to ſpeak for itſelf; which I hope, the kind reader will find to anſwer to the title, and the recommendation given it. As to the rules, they follow in the ſame manner as the table of contents ſpecifies, and much in the ſame order as they are generally taught in ſchools. I have gone through the four fundamental rules in Integers firſt, before thoſe of the ſeveral Denominations, in order that they being well underſtood, the latter will be performed with much more eaſe and deſpatch, according to the rules ſhewn, than by the cuſtomary method of dotting. In Multiplication I have ſhewn both the beauty and uſe of that excellent rule, in reſolving moſt queſtions that occur in merchandizing; and have prefixed before Reduction, ſeveral bills of parcels, which are applicable to real buſineſs. In working Intereſt by Decimals, I have added tables to the rules, for the readier calculating annuities, &c. and have not only ſhewn the uſe, but the method of making them. I have alſo added to this *Edition*, a NEW RULE for extracting the *Cube-Root*, being a much ſhorter way than any that is already publiſhed; as likewiſe an Intereſt-table, calculated for the eaſier finding the intereſt of any ſum of money, at any rate *per cent.* by Multiplication and Addition only: It is alſo uſeful in calculating rents, incomes, and ſervants' wages, for any number of months, weeks, or days; and I may venture to ſay, I have gone through the whole with ſo much plainneſs and perſpicuity that there is none better extant.

I have nothing further to add, but a return of my ſincere thanks to all thoſe Gentlemen, Schoolmaſters, and others, whoſe kind approbation and encouragement have now eſtabliſhed the uſe of this book in almoſt every ſchool of eminence throughout the kingdom; but I think my gratitude more eſpecially due to thoſe who have favoured me with their remarks; though I muſt ſtill beg of every candid and judicious reader, that if he ſhould, by chance, find a tranſpoſition of a letter, or a falſe figure, to excuſe it; for, notwithſtanding there has been great care taken in correcting, yet errors of the preſs will inevitably creep in; and ſome may alſo have ſlipped my obſervation; in either of which caſes, the admonition of a good-natured reader will be very acceptable to his

much obliged

and moſt obedient

humble Servant,

F. WALKINGAME.

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EXPLANATION OF THE CHARACTERS made Use of in this COMPENDIUM.

$=$ *Equal.*	The Sign of Equality; as, 4 qrs. $=1$ cwt. ſignifies, that 4 qrs. are equal to 1 cwt.
$-$ *Minus or leſs.*	The Sign of Subſtraction; as, $8-2=6$; that is, 8 leſſened by 2 is equal to 6.
$+$ *Plus or more.*	The Sign of Addition; as, $4+4=8$; that is, 4 added to 4 more is equal to 8.
$\times$ *Multiplied by.*	The Sign of Multiplication; as, $4\times 6=24$; that is, 4 multiplied by 6 is equal to 24.
$\div$ *Divided by.*	The Sign of Diviſion; as, $8\div 2=4$; that is, 8 divided by 2 is equal to 4.
$\frac{2357}{63}$	Numbers placed like a fraction, do likewiſe denote Diviſion; the upper number being the dividend, and the lower the diviſor.
$::$ *So is.*	The Sign of Proportion; as, $2:4::8:16$ that is, as 2 is to 4 ſo is 8 to 16.
$7-2+5=10$	Shews that the difference between 2 and 7 added to 5 is equal to 10.
$9-\overline{2+5}=2$	Signifies, that the ſum of 2 and 5 taken from 9 is equal to 2.
$\sqrt{}$	Prefixed to any number, ſignifies the Square Root of that number is required.
$\sqrt[3]{}$	Signifies the Cube, or third power.
$\sqrt[4]{}$	Denotes the Biquadrate, or the fourth power, &c.
i. e.	*id eſt*, that is.

THE

THE

TUTOR's ASSISTANT;

BEING A

COMPENDIUM OF ARITHMETIC &c.

PART I.

ARITHMETIC IN WHOLE NUMBERS.

THE INTRODUCTION.

ARITHMETIC is the art or ſcience of computing by numbers, and conſiſts both in theory and practice.

The *theory* conſiders the nature and quality of numbers, and demonſtrates the reaſon of practical operations.

The *practice* is that which ſhews the method of working by numbers, ſo as to be the moſt uſeful and expeditious buſineſs, and has five principal or fundamental rules for the operations, *viz.*

NOTATION OR NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NUMERATION

TEACHETH the different value of figures by their different places, and to read and write any ſum or number.

The TABLE.

C Millions.	X Millions.	Millions.		C Thouſands.	X Thouſands.	Thouſands.		Hundreds.	Tens.	Units.
9	8	7	·	6	5	4	·	3	2	1
9	0	0	·	0	0	0	·	0	0	0
	8	0	·	0	0	0	·	0	0	0
		7	·	0	0	0	·	0	0	0
				6	0	0	·	0	0	0
					5	0	·	0	0	0
						4	·	0	0	0
								3	0	0
									2	0
										1

RULE. There are three periods; the firſt on the right hand, units; the ſecond, thouſands; and the third millions; each conſiſting of three figures or places. Reckon the firſt figure of each, from the left hand, as ſo many hundreds, the next as tens, and the third as ſo many ſingle ones of what is written over them: as the firſt period on the left-hand is read thus, nine hundred and eighty-ſeven millions; and ſo on for any of the reſt.

The APPLICATION.

Write down in proper figures the following numbers.

Twenty-three.

Two hundred and fifty-four.

Three thouſand, two hundred and four.

Twenty-five thouſand, eight hundred fifty-ſix.

One hundred thirty two thouſand, two hundred forty-five.

Four millions, nine hundred forty-one thouſand, four hundred.

Twenty-ſeven millions, one hundred fifty-ſeven thouſand, eight hundred thirty-two.

Seven hundred twenty-two millions, two hundred thirty-one thouſand, five hundred four.

Six hundred two millions, two hundred ten thouſand, five hundred.

Write down in words at length the following numbers.

35	2016	519007	5204054	65700047
59	5201	750058	2071909	90006157
172	20760	5900030	70054008	201900790

Notation by ROMAN *Letters.*

I.	One.	XXX.	Thirty.
II.	Two.	XL.	Forty.
III.	Three.	L.	Fifty.
IV.	Four.	LX.	Sixty.
V.	Five.	LXX.	Seventy.
VI.	Six.	LXXX.	Eighty.
VII.	Seven.	XC.	Ninety.
VIII.	Eight.	C.	Hundred.
IX.	Nine.	CC.	Two hundred.
X.	Ten.	CCC.	Three hundred.
XI.	Eleven.	CCCC.	Four hundred.
XII.	Twelve.	D.	Five hundred.
XIII.	Thirteen.	DC.	Six hundred.
XIV.	Fourteen.	DCC.	Seven hundred.
XV.	Fifteen.	DCCC.	Eight hundred.
XVI.	Sixteen.	DCCCC.	Nine hundred.
XVII.	Seventeen.	M.	One thouſand.
XVIII.	Eighteen.	M,DCC,XCVI.	One thouſand ſeven hundred and ninety-ſix.
XIX.	Nineteen.		
XX.	Twenty.		

INTEGERS

ADDITION

TEACHETH to add two or more ſums together, to make one whole or total ſum.

RULE. There muſt be due regard had in placing the figures one under the other, *i. e.* units under units, tens under tens, *&c.* then beginning with the firſt row of units, add them up to the top; when done, ſet down the units, and carry the tens to the next, and ſo on; continuing to the laſt row, at which ſet down the total amount.

PROOF. Begin at the top of the ſum, and reckon the figures downwards, the ſame as you add them up, and, if the ſame as the firſt, the ſum is ſuppoſed to be right.

ADDITION and SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

£.	*Cwt.*	*Qrs.*	*Months.*	*£.*	*Years.*
2	27	276	1234	7524	27104
5	35	110	7098	3750	32547
7	47	473	3314	9147	10758
9	35	354	6732	3215	62590
2	41	271	2546	4725	75408
5	36	352	3709	2147	27973
4	59	471	4152	3254	8542
3	37	310	3705	2716	12706
7	14	437	1076	1047	10471
44	331				

SUBTRACTION.

TEACHETH to take a leſs number from a greater, and ſhews the remainder, or difference.

RULE. This being the reverſe of Addition, you muſt borrow here (if it requires) what you ſtopped at there, always remembering to pay it to the next.

PROOF. Add the remainder and leſs line together, and if the ſame as the greater, it is right.

	£.	*Hund.*	*Hours.*	*Weeks.*	*Hhds.*	*Minutes.*
From	271	4754	42087	432705	271508	3750214
Take	154	2725	34096	327616	152741	2150173
Rem.	117					
Proof.	271					

MULTIPLICATION.

TEACHETH how to increaſe the greater of two numbers given, as often as there are units in the leſs; and compendiouſly performs the office of many additions.

To this rule belong three principal members; *viz.*

1. The multiplicand, or number to be multiplied:
2. The multiplier, or number by which you multiply:
3. The product, or number produced by multiplying.

RULE. Begin with that figure that ſtands in the unit's place of the multiplier, and with it multiply the firſt figure in the unit's place of the multiplicand. Set down the units, and carry the tens in mind till you have multiplied the next figure in the multiplicand by the ſame figure in the multiplier; to the product of which add the tens you kept in mind, ſetting down the units, and proceed as before, till the whole line is multiplied.

PROOF. The uſual way of proving multiplication is, by caſting out the nines from the multiplicand and multiplier; the remainders put on each ſide of a croſs; multiply the figures on each ſide together, caſt out the nines from the product, and put the overplus at top; then caſt out the nines from the product of the multiplication, and its remainder place at the bottom; if it agree with the top, the work is ſuppoſed right: but the ſureſt way is, to divide the product by the multiplicand, and the quotient will be the ſame as the multiplier.

MULTIPLICATION and DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Multiplicand	25104736	52471021	7925437521
Multiplier	2	3	4
Product	50209472		

27104107	231037	7062526	3723104
5	6	7	8

4214406	2701047	31040171	35210472
9	10	11	12

When the multiplier is more than twelve, and leſs than 20, multiply by the unite figure in the multiplier, adding to the product the back figure to that you multiplied.

4710572	5107252	6653210	92057165
13	14	15	16

6251721	9215324	2571341	3592104
17	18	19	19

When the multiplier conſiſts of ſeveral figures, there muſt be as many products as there are figures in the multiplier, obſerving to put the firſt figure of every product under that figure you multiply by. Add the ſeveral products together, and their ſum will be the total produce.

0	271041	32104	2710432	27501976
6+0	27	25	375	271
0				
	1874287	802600	1016412000	7453035496
	542082			
	7318107			

When cyphers are placed between the ſignificant figures in the multiplier, they may be omitted; but great care muſt be taken that the next figure be put one place more to the left-hand, *i. e.* under the figure you multiply by.

571204

571204	7104325	5271094
27009	57020	590030
15427648836	405088611500	3110103592820

When there are cyphers at the end of the multiplicand, or multiplier, they may be omitted, by only multiplying by the reſt of the figures, and ſetting down on the right-hand of the total product as many cyphers as were omitted.

27100	379500	265000	574000
52600	274000	7200	630
1425460000	103983000000	1908000000	561620000

When the multiplier is a compoſite number, *i. e.* if any two figures being multiplied together, will make that number, then multiply by one of theſe figures, and that product by the other will give the anſwer.

771039 by 35	921563 by 32	715241 by 56
26986365	29490016	40053496

DIVISION

TEACHETH to find how often one number is contained in another, or to Divide any number into what parts you pleaſe.

In this rule there are three numbers real, and a fourth accidental, *viz.*

1. The dividend, or number to be divided :

2. The diviſor, or number by which you divide :

3. The quotient, or number that ſhews how often the diviſor is contained in the dividend :

4th, or accidental number, is what remains when the work is finiſhed, and is of the ſame name as the dividend.

RULE. When the diviſor is leſs than 12, find how often it is contained in the firſt figure of the dividend, ſet it down under the figure you divided, and carry the overplus (if any) to the next in the dividend, as ſo many tens ; then find how often the diviſor is contained therein, ſet it down, and continue the ſame till you have gone through the line; but when the diviſor is more than 12, multiply it by the quotient figure; the product ſubtract from the dividend, and to the remainder bring down the next figure in the dividend, and proceed as before, till the figures are all brought down.

Proof. Multiply the diviſor and quotient together, adding the remainder (if any), and the product will be the ſame as the dividend.

Divid. Rem.
Diviſor 2)725107(1 3)7221472(4)72104l6(
Quotient 392553
2
Proof 725107 5)72032287(6)5231037(

7)2332701(8)2547325(9)25048306(

10)2750012(11)2710513(12)27100732(

Divi∫. Divid. Quot.
29)4172377(143875
29 29
127 1294875
116 287750
2 Rem.
.112 4172377 Proof.
87
.253
232
.217
203
.147
145
Rem. . .2

37)7210473(194877
473)2104721(4449
275)3720147(13527
3701)72109521(19483
3576)72104725(20163
2510)63210476(25183
25204)321047217(12737
31709)5210473 21(16432
2701234)7210472532(2669
210472)3521071932 14(1672940
3721071)21071921473(5662

When there are cyphers at the end of the diviſor, they may be cut off, and as many places from off the dividend, but muſt be annexed to the remainder at laſt.

271|00)254732|21(939 5721|00)7253472|15(1267
373|000)752473|719(2017 215|000)6325104|997(29419

When the diviſor is a compoſite number, (*i. e.* if any two figures being multiplied together, will make that number) then by dividing the dividend by one of thoſe figures and that quotient by the other, it will give the quotient required.—But as it ſometimes happens, that there is a remainder to each of the quotients, and neither of them the true one, it may be found by this

Rule. Multiply the firſt diviſor into the laſt remainder, to that product add the firſt remainder, which will give the true one.

Div. 3210473 by 27.	7210473 by 35.	6251043 by 42.	5761034 by 54.
118906. 11 R.	206013. 18 R.	148834. 15 R.	106685. 44 R.

Marked	MONEY.	Marked
¼ *Farthing.*	4 Farthings make	1 Penny - *d.*
½ *Halfpenny.*	12 Pence ——	1 Shilling *s.*
¾ *Three Farthings.*	20 Shillings ——	1 Pound - *l.*

4 Farthings = 1 *Penny.*
48 = 12 = 1 *Shilling.*
960 = 240 = 20 = 1 *Pound.*

SHILLINGS.

s.		£.	s.
20		1	0
30		1	10
40		2	0
50		2	10
60		3	0
70	is	3	10
80		4	0
90		4	10
100		5	0
110		5	10
120		6	0
130		6	10

PENCE TABLE.

d.		s.	d.	d.		s.	d.
20		1	8	90		7	6
24		2	0	96		8	0
30		2	6	100		8	4
36		3	0	108		9	0
40		3	4	110		9	2
48	is	4	0	120	is	10	0
50		4	2	130		10	10
60		5	0	132		11	0
70		5	10	140		11	8
72		6	0	144		12	0
80		6	8	150		12	6
84		7	0	160		13	4

TROY WEIGHT.

			Marked
24 Grains	make	1 Pennyweight.	*gr.* *dwts.*
20 Pennyweights	——	1 Ounce — —	*oz.*
12 Ounces —	——	1 Pound — —	*lb.*

Grains.
24 = 1 Pennyweight.
480 = 20 = 1 Ounce.
5760 = 240 = 12 = 1 Pound.

By this weight are weighed gold, ſilver, jewels, electuaries, and all liquors.

☞ The ſtandard for gold coin is 22 carats of fine gold, and 2 carats of copper melted together. For ſilver, is 11 *oz*, 2 *dwts.* of fine ſilver, 18 *dwts.* of copper.

25 *lb.* is a quarter of an *cwt.* 100 *lb.* 1 *cwt.*
20 *cwt.* 1 ton of gold or ſilver.

AVOIRDUPOISE WEIGHT.

			Marked
16 Drams	make	1 Ounce	*dr.* *oz.*
16 Ounces	——	1 Pound —	*lb.*
28 Pounds	——	1 Quarter —	*qrs.*
4 Quarters, or 112 *lb.*		1 Hundred weight	*cwt.*
20 Hundred weight		1 Ton —	*ton.*

Drams.
16 = 1 Ounce.
256 = 16 = 1 Pound.
7168 = 448 = 28 = 1 Quarter.
28672 = 1792 = 112 = 4 = 1 Cwt.
573440 = 35840 = 2240 = 80 = 20 = 1 Ton.

There are ſeveral other denominations in this weight, that are uſed in ſome particular goods, *viz.*

	lb.		*lb.*
A firkin of Butter —	56	A ſtone of Iron-ſhot, or horſeman's wt.	14
Soap —	64	A ſtone of butcher's meat	8
A barrel of Anchovies	30	A gallon of Train-oil	7½
Soap —	256	A truſs of Straw	36
Raiſins —	112	new Hay	60
A puncheon of Prunes	1120	old Hay	56
A fother of lead, 19 *cwt.* 2 *qrs.*		36 Truſſes a load.	

CHEESE and BUTTER.

A clove, or half ſtone, 8 *lb.*

	lb.		*lb.*
A wey in Suffolk, 32 cloves, or	256	A wey in Eſſex, 42 cloves, or	336

WOOL.

	lb.		*lb.*
A clove — —	7	A wey is 6 tod and 1 ſtone, or	182
A ſtone — —	14	A ſack is 2 weys, or	364
A tod — —	28	A laſt is 12 ſacks, or	4368

By this weight is weighed any thing of a coarſe or droſſy nature; as all groceries or chandlery wares; bread, and all metals but ſilver and gold.

Note. 1 pound Avoirdupoiſe is equal to 14 *oz.* 11 *dwts.* $15\frac{1}{2}$ *grs.* Troy.

APOTHECARIES' WEIGHT.

					Marked
20 Grains	make	—	1 Scruple	—	℈
3 Scruples	——	—	1 Dram	—	ʒ
8 Drams	——	—	1 Ounce	—	℥
12 Ounces	——	—	1 Pound	—	℔

Grains.

20 = 1 Scruple.

60 = 3 = 1 Dram.

480 = 24 = 8 = 1 Ounce.

5760 = 288 = 96 = 12 = 1 Pound.

Note, The Apothecaries mix their medicines by this rule, but buy and ſell their commodities by Avoirdupoiſe weight.

The Apothecaries pound and ounce, and the pound and ounce Troy are the ſame, only differently divided and ſub-divided.

CLOTH MEASURE.

					Marked
4 Nails	make	—	1 Quarter of a yard.		*n.* *qrs.*
3 Quarters	——	—	1 Flemiſh ell	——	*F. E.*
4 Quarters	——	—	1 Yard —	——	*yd.*
5 Quarters	——	—	1 Engliſh ell	——	*E. E.*
6 Quarters	——	—	1 French ell	——	*Fr. E.*

Inches.
2¼ = 1 Nail.
9 = 4 = 1 Quarter.
36 = 16 = 4 = 1 Yard.
27 = 12 = 3 = 1 Flemiſh ell.
45 = 20 = 5 = 1 Engliſh ell.

LONG MEASURE.

				Marked
3 Barley corns make		1 Inch	—	*bar.* *in.*
12 Inches	——	1 Foot	——	*feet.*
3 Feet	——	1 Yard	——	*yd.*
6 Feet	——	1 Fathom	——	*fth.*
5½ Yards	——	1 Rod, pole, or perch		*rod. p.*
40 Poles	——	1 Furlong	——	*fur.*
8 Furlongs	——	1 Mile	——	*mile.*
3 Miles	——	1 League	——	*leag.*
60 Miles	——	1 Degree	——	*deg.*

Barley corns.
3 = 1 Inch.
36 = 12 = 1 Foot.
108 = 36 = 3 = 1 Yard.
594 = 198 = 16½ = 5½ = 1 Pole.
23760 = 7920 = 660 = 220 = 40 = 1 Furlong.
190080 = 63360 = 5280 = 1760 = 320 = 8 = 1 Mile.

☞ A degree is 69 miles, 4 furlongs, nearly, though commonly reckoned but 60 miles.

This meaſure is uſed to meaſure diſtance of places, or any thing elſe that has length only.

WINE MEASURE.

					Marked
2 Pints	make	—	1 Quart		*pt.* *qts.*
4 Quarts	——	—	1 Gallon	——	*gal.*
10 Gallons	——	—	1 Anker of brandy		*ank.*
18 Gallons	——	—	1 Runlet	——	*run.*
31½ Gallons	——	—	Half a hogſhead		*½hhd.*
42 Gallons	——	—	1 Tierce	——	*tierce.*
63 Gallons	——	—	1 Hogſhead	——	*hhd.*
2 Hogſheads	——	—	1 Pipe or butt		*p.* or *butt.*
2 Pipes, or 4 hogſheads			1 Tun	——	*tun.*

Cubic Inches.
28⅞ = 1 Pint.
57¾ = 2 = 1 Quart.
231 = 8 = 4 = 1 Gallon.
9702 = 336 = 168 = 42 = 1 Tierce.
14553 = 504 = 252 = 63 = 1½ = 1 Hogſhead.
19404 = 672 = 336 = 84 = 2 = 1¾ = 1 Punch.
29106 = 1008 = 504 = 126 = 3 = 2 = 1½ = 1 Pipe.
58212 = 2016 = 1008 = 252 = 6 = 4 = 3 = 2 = 1 Tun.

All brandies, ſpirits, perry, cyder, mead, vinegar, honey, and oil are meaſured by this meaſure; as alſo milk, not by law, but cuſtom only.

ALE and BEER MEASURE.

			Marked
2 Pints	make	1 Quart	*pts.* *qts.*
4 Quarts	——	1 Gallon	*gal.*
8 Gallons	——	1 Firkin of ale	*A. fir.*
9 Gallons	——	1 Firkin of beer	*B. fir.*
2 Firkins	——	1 Kilderkin	*kil.*
4 Firkins, or 2 kilderkins	——	1 Barrel	*bar.*
1 Barrel and ½, or 54 gal.	——	1 Hogſhead of beer	*hhd.*
2 Barrels	——	1 Puncheon	*pun.*
3 Barrels, or 2 hogſheads	——	1 Butt	*butt.*

BEER.

Cubic Inches.
35¼ = 1 Pint.
70½ = 2 = 1 Quart.
282 = 8 = 4 = 1 Gallon.
2538 = 72 = 36 = 9 = 1 Firkin.
5076 = 144 = 72 = 18 = 2 = 1 Kilderkin.
10152 = 288 = 144 = 36 = 4 = 2 = 1 Barrel.
15228 = 432 = 216 = 54 = 6 = 3 = 1½ = 1 Hogſhead.
20304 = 576 = 288 = 72 = 8 = 4 = 2 = 1 Puncheon.
30456 = 864 = 432 = 108 = 12 = 6 = 3 = 2 = 1 Butt.

ALE.

Cubic Inches.
35¼ = 1 Pint.
70½ = 2 = 1 Quart.
282 = 8 = 4 = 1 Gallon.
2256 = 64 = 32 = 8 = 1 Firkin.
4512 = 128 = 64 = 16 = 2 = 1 Kilderkin.
9024 = 256 = 128 = 32 = 4 = 2 = 1 Barrel.
13536 = 384 = 192 = 48 = 6 = 3 = 1½ = 1 Hogſhead.

In *London* they compute but 8 gallons to the firkin of ale, and 32 to the barrel; but in all other parts of England, for ale, ſtrong beer, and ſmall, 34 gallons to the barrel, and $8\frac{1}{2}$ gallons to the firkin.

☞ A barrel of ſalmon, or eels is 42 gallons.
A barrel of herrings — 32 gallons.
A keg of ſturgeon — 4 or 5 gallons.
A firkin of ſoap — 8 gallons.

DRY MEASURE.

			Marked
2 Pints	make	1 Quart	*pts.* *qts.*
2 Quarts	—	1 Pottle	*pot.*
2 Pottles	—	1 Gallon	*gal.*
2 Gallons	—	1 Peck	*pk.*
4 Pecks	—	1 Buſhel	*buſh.*
2 Buſhels	—	1 Strike	*ſtrike.*
4 Buſhels	—	1 Coom	*coom.*
2 Cooms, or 8 Buſhels	—	1 Quarter	*qr.*
4 Quarters	—	1 Chaldron	*chal.*
5 Quarters	—	1 Wey	*wey.*
2 Weys	—	1 Laſt	*laſt.*

In *London* 36 buſhels make a chaldron.

Solid Inches.
$268\frac{4}{5}$ = 1 Gallon.
$537\frac{3}{5}$ = 2 = 1 Peck.
$2150\frac{2}{5}$ = 8 = 4 = 1 Buſhel.
$4300\frac{4}{5}$ = 16 = 8 = 2 = 1 Strike.
$8601\frac{3}{5}$ = 32 = 16 = 4 = 2 = 1 Coom.
$17203\frac{1}{5}$ = 64 = 32 = 8 = 4 = 2 = 1 Quarter.
86016 = 320 = 160 = 40 = 20 = 10 = 5 = 1 Wey.
172032 = 640 = 320 = 80 = 40 = 20 = 10 = 2 = 1 Laſt.

The buſhel in *Water Meaſure* is 5 pecks.

A ſcore of coals is 21 Chaldron.
A ſack of coals — 3 Buſhels.
A chaldron of coals — 12 Sacks.
A load of corn — 5 Buſhels.
A cart load ditto — 40 Buſhels.

This meaſure is applied to all dry goods.

The ſtandard buſhel is $18\frac{1}{2}$ inches wide, and 8 inches deep.

TIME.

			Marked.
60 Seconds	make	1 Minute	*″* *m.*
60 Minutes	——	1 Hour	*hour.*
24 Hours	——	1 Day	*day.*
7 Days	——	1 Week	*week.*
4 Weeks	——	1 Month	*mo.*
13 Months 1 day, 6 hours	——	Julian year	*yr.*

Seconds.
60= 1 Minute.
3600= 60= 1 Hour.
86400= 1440= 24= 1 Day.
604800=10080=168= 7=1 Week.
2419200=40320=672=28=4=1 Month.
d h w d h
31557600=525960=8766=365 6=52:1:6=1 Julian yr.
d h m ″
31556937=525948=8765=365:4:48:57=1 Solar year.

To know the days in each month, obſerve:

Thirty days hath September,
April, June, and November;
February hath twenty eight alone,
All the reſt hath thirty and one;
Except in Leap year, and then's the time,
February's days are twenty and nine.

SQUARE MEASURE.

144 Inches	make	1 Foot.
9 Feet	——	1 Yard.
100 Feet	——	1 Square of flooring.
272¼ Feet	——	1 Rod.
40 Rods	——	1 Rood.
4 Roods, or 160 rods, or 4840 yards		1 Acre of land.
640 Acres	——	1 Square Mile.
30 Acres	——	1 Yard of land.
100 Acres	——	1 Hide of land.

Inches.
144 = 1 Foot.
1296 = 9 = 1 Yard.
39204 = 272¼ = 30¼ = 1 Pole.
1568160 = 10890 = 1210 = 40 = 1 Rood.
6272640 = 43560 = 4840 = 160 = 4 = 1 Acre.

By this meaſure are meaſured all things that have length and breadth; ſuch as land, painting, plaiſtering, flooring, thatching, plumbing, glazing, &c.

SOLID MEASURE.

1728 Inches make 1 Solid Foot.
27 Feet —— 1 Yard, or load of earth.
Or, 40 Feet of round timber, } is 1 ton or load.
50 Feet of hewn timber, }

108 Solid feet, *i. e.* 12 feet in length, 3 feet in breadth, and 3 deep; or, commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a ſtack of wood.

128 Solid feet, *i. e.* 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

By this meaſure, are meaſured all things that have length, breadth, and depth.

ADDITION of MONEY, WEIGHTS, and MEASURES.

RULE. Add the firſt row or denomination together, as in Integers; then divide the ſum by as many of the ſame denomination as make one of the next greater, ſetting down the remainder under the row added, and carry the quotient to the next ſuperior denomination, continuing the ſame to the laſt, which add as in Simple Addition.

£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
2	13	5½	27	7	2	35	17	3	75	3	7
7	9	4¼	34	14	7¼	59	14	7½	54	17	1½
5	15	4½	57	19	2¼	97	13	5¼	91	15	4¼
9	17	6¼	91	16	1	37	16	8¼	35	16	5¼
7	16	3	75	18	7¾	97	15	7	29	19	7¼
5	14	7¾	97	13	5	59	16	5½	91	17	3¼
39 :	6 :	7¼									

MONEY.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
257	1	5½	525	2	4¼	21	14	7¼	73	2	1½
734	3	7¾	179	3	5	75	16	0	25	12	7
595	5	3	250	4	7¼	79	2	4¼	96	13	5½
159	14	7½	975	3	5¼	57	16	5½	76	17	3¼
207	5	4	254	5	7	26	13	8¾	97	14	1
798	16	7¼	379	4	5¾	54	2	7	54	11	7¾

127	4	7½	261	17	1¼	31	1	1½	27	13	5
525	3	5	379	13	5	75	13	1	16	12	9¼
271	—	5	257	16	7¾	39	19	7½	9	13	3
524	9	1	184	13	5	97	17	3¼	15	2	7½
379	4	3½	725	2	3¼	36	13	5	37	19	0
215	5	8¾	359	6	5	24	16	3¼	56	19	1¾

TROY WEIGHT.

oz.	*dwt.*	*gr.*	*oz.*	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*lb.*	*oz.*	*dwt.*
7	15	21	5	11	4	7	1	2	5	2	15
3	17	6	7	19	21	3	2	7	13	11	17
2	5	15	3	15	14	5	1	5	13	7	15
3	16	19	7	19	22	2	7	3	13	9	7
9	18	23	9	18	15	7	10	1	19	1	13
7	15	14	8	13	12	3	11	7	15	2	15

AVOIRDUPOISE WEIGHT.

lb.	*oz.*	*dr.*	*lb.*	*oz.*	*dr.*	*cwt.*	*qrs.*	*lb.*	*T.*	*cwt.*	*qrs.*
152	15	15	17	12	3	25	1	17	7	17	2
272	14	10	23	15	6	72	3	26	5	5	3
353	15	11	31	11	14	54	1	16	2	4	1
255	10	4	97	—	9	24	1	16	3	18	2
173	6	2	48	7	15	17	–	19	7	9	3
635	13	13	79	10	6	55	2	16	8	5	1

APOTHECARIES WEIGHT.

ʒ	℈	gr.	℥	ʒ	℈	gr.	℔	℥	ʒ	℈	℔	℥	ʒ	℈
7	0	17	9	2	–	17	7	10	7	1	7	2	1	–
3	1	18	3	5	2	19	9	5	2	2	3	1	7	1
6	2	16	9	2	1	14	7	11	1	2	9	10	2	0
5	1	15	3	5	–	18	9	5	6	1	7	5	7	1
7	–	18	7	7	2	15	7	10	5	2	3	9	5	2
3	1	9	3	3	–	—	9	—	7	—	7	1	4	1

CLOTH MEASURE.

FE.	*qrs.*	*n.*	*yds.*	*qrs.*	*n.*	*yds.*	*qrs.*	*n.*	*EE.*	*qrs.*	*n.*
27	2	1	35	3	3	73	3	2	71	2	1
15	1	3	70	2	2	97	1	3	52	1	2
37	–	2	95	3	–	54	–	2	79	–	1
52	1	3	76	1	3	76	2	–	56	2	–
76	2	1	26	–	1	59	1	3	79	3	1
97	1	3	79	2	1	76	2	2	54	2	1

LONG MEASURE.

feet	*in.*	*bar.*	*yd.*	*feet.*	*in.*	*m.*	*fur.*	*p.*	*lea.*	*m.*	*fur.*
27	1	2	25	1	9	35	7	3	72	2	1
35	10	1	71	–	3	27	5	27	27	1	17
17	2	0	52	2	3	52	–	35	53	2	5
35	11	1	97	–	10	97	1	17	79	–	6
97	2	2	54	2	7	56	7	18	51	1	6
54	8	1	37	1	4	91	5	27	72	–	5

LAND MEASURE.

a.	*r.*	*p.*	*a.*	*r.*	*p.*	*a.*	*r.*	*p.*	*a.*	*r.*	*p.*
73	3	27	27	1	35	26	1	31	32	1	14
36	2	15	29	2	19	19	2	17	27	–	19
97	1	16	3	1	15	55	3	14	31	2	15
35	2	15	95	2	27	79	1	21	19	1	18
27	1	14	62	–	13	95	2	14	59	2	17

WINE MEASURE.

pun.	*gal.*	*qts.*	*tier.*	*gal.*	*qts.*	*hhds.*	*gal.*	*qts.*	*T.*	*hhd.*	*gal.*
27	17	2	25	36	2	31	57	1	14	3	27
35	15	3	75	41	2	97	18	2	19	2	56
56	14	1	62	15	1	76	13	1	17	–	39
97	10	3	94	13	2	55	46	2	75	2	16
12	15	–	15	24	3	87	38	3	54	1	19
79	3	1	19	16	1	55	17	1	97	3	54

ALE *and* BEER MEASURE.

A.B.	*fir.*	*gal.*	*B.B*	*fir*	*gal.*	*hhd.*	*gal.*	*qts.*	*hhd.*	*gal.*	*qt.*
25	2	7	37	2	8	76	51	2	76	2	1
17	3	5	54	1	7	57	3	3	95	35	2
96	2	6	97	3	8	97	27	3	57	16	3
75	1	4	78	2	5	22	17	3	22	14	1
96	3	7	47	–	7	32	19	3	32	37	3
75	–	5	35	2	5	55	38	–	55	16	1

DRY MEASURE.

qr.	*bu.*	*p.*	*qr.*	*bu.*	*p.*	*ch.*	*bu.*	*p.*	*ch.*	*bu.*	*p.*
75	7	2	36	2	1	75	27	2	73	2	1
36	2	3	71	–	3	57	3	1	41	24	1
51	2	–	53	6	–	95	25	3	92	16	1
79	7	1	82	4	1	76	35	2	70	13	2
55	–	3	95	3	3	97	25	2	54	17	3
96	2	1	78	2	1	75	16	3	79	25	1

TIME.

h.	*m.*	″	*d.*	*h.*	*m.*	*w.*	*d.*	*h.*	*w.*	*d.*	*h.*
52	57	35	72	23	26	71	3	11	57	2	15
97	16	27	54	14	35	51	2	9	95	3	21
16	51	54	97	12	31	76	–	21	76	–	15
96	18	31	58	21	45	95	3	21	53	2	21
75	34	21	96	20	48	79	1	15	98	2	18

The APPLICATION.

1. A man born in the year 1750, when will he be 47 years of age? *Anſ.* 1797.

2. *A, B, C, D,* wet partners in the purchaſe of a quantity of goods; *A* laid out 7*l.* half a guinea, and a crown; *B* 49*s.*; *C* 54*s.* 6*d.* and *D* 87*d.*—What was laid out in all? *Anſ.* £13 : 6 : 3.

3. A man lent his friend at different times theſe ſeveral ſums, *viz.* 63*l.*; 25*l.* 15*s.*; 32*l.* 7*s.*; 15*l.* 14*s.* 10*d.*; and fourſcore and nineteen pounds, half a guinea, and a ſhilling. How much did he lend in all? *Anſ.* £236 : 8 : 4.

4. What is the eſtate worth *per annum*, when the taxes are 21 guineas, the neat income 8 ſcore 19*l.* 14*s.*
Anſ. £201 : 15*s.*

5. There are three numbers; the firſt 215, the ſecond 519, and the third is as much as the other two—what is the ſum of them all? *Anſ.* 1468.

6. Bought a parcel of goods, for which I paid 54*l.* 17*s.*; for packing 13*s.* 8*d.*; carriage 1*l.* 5*s.* 4*d.*; and ſpent about the bargain 14*s.* 3*d.*—What do theſe goods ſtand me in?
Anſ. £57 : 10 : 3.

7. There are two numbers; the leaſt whereof is 40, their difference 14;—I deſire to know what is the greater number and the ſum of both? *Anſ.* 54 *greater number*, 94 *ſum*.

8. A gentleman left his eldeſt daughter 1500*l.* more than the youngeſt, and her fortune was 11 thouſand, 11 hundred, and 11*l.*—What was the eldeſt ſiſter's fortune, and what did the father leave them?
Anſ. Eldeſt ſiſter's fortune £13611. *Father left them* £25722.

9. A nobleman, before he went out of town, was deſirous of paying all his tradeſmen's bills, and upon inquiry he found that he owed 82 guineas for rent; to his wine-merchant 72*l.* 5*s.*; to his confectioner 12*l.* 13*s.* 4*d.*; to his draper 47*l.* 13*s.* 2*d.*; to his tailor 110*l.* 15*s.* 6*d.*; to his coach-maker 157*l.* 18*s.*; to his tallow-chandler 8*l.* 17*s.* 9*d.*; to his corn-chandler 170*l.* 6*s.* 8*d.*; to his brewer 52*l.* 17*s.*; to his butcher 122*l.* 11*s.* 5*d.*; to his baker 37*l.* 9*s.* 5*d.*; and to his ſervants for wages 53*l.* 18*s.*—I deſire to know what money he had to raiſe in the whole, when we add to the above ſums 100*l.* which he wiſhed to take with him? *Anſ.* £1037 : 17 : 3.

10. A father was 24 years of age (allowing 13 months to a year, and 28 days to a month) when his firſt child was born; between the eldeſt and the next born was 1 year, 11 months, and 14 days; between the ſecond and third were 2 years, 1 month, and 15 days; between the third and fourth were two years, 10 months, and 25 days; when the fourth was 27 years, 9 months, and 12 days old, how old was the father? *Anſ.* 58 *years*, 7 *months*, 10 *days*.

11. A banker's clerk, having been out with bills, brings home an account, that A paid him 7*l.* 5*s.* 2*d.* B 15*l.* 18*s.* 6½*d.* C 150*l.* 13*s.* 2¼*d.* D 17*l.* 6*s.* 8*d.* E 5 guineas, 2 crown-pieces, 4 half crowns, and 4*s.* 2*d.* F paid him only 20 groats, G 76*l.* 15*s.* 9½*d.* and H 121*l.* 12*s.* 4*d.* I deſire to know how much the whole amounted to that he had to pay? *Anſ.* £396 : 7 : 6¼.

12. A nobleman had a ſervice of plate, which conſiſted of twenty diſhes weighing 203 *oz.* 8 *dwts.*; 36 plates weighing 408 *oz.* 9 *dwts.* 5 dozen of ſpoons, weighing 112 *oz.* 8 *dwts.*; 6 ſalts and ſix pepper boxes, weighing 71 *oz.* 7 *dwts.*; knives and forks, weighing 73 *oz.* 5 *dwts.* two large cups, a tankard, and a mug, weighing 121 *oz.* 4 *dwts.*; a tea-kettle and lamp, weighing 131 *oz.* 7 *dwt.*; together with ſundry other ſmall articles weighing 185 *oz.* 5 *dwts.* I deſire to know the weight of the whole? *Anſ.* 102*lb.* 2 *oz.* 13 *dwts.*

13. A hop merchant buys 5 bags of hops, of which the firſt weighed 2 *cwt.* 3 *qrs.* 13*lb.*; the ſecond 2 *cwt.* 2 *qrs.* 11*lb.*; the third 2 *cwt.* 3 *qrs.* 5*lb.*; the fourth 2 *cwt.* 3 *qrs.* 12*lb.*; the fifth 2 *cwt.* 3 *qrs.* 15*lb.* Beſides theſe, he purchaſed two pockets, each weighing 84*lb.* I deſire to know the weight of the whole. *Anſ.* 15 *cwt.* 2 *qrs.*

14. A, of Vienna, owes to B, of Liverpool, for goods received in January, the ſum of 103*lb.* 12*s.* 2*d.*; for goods received in February 93*l.* 3*s.* 4*d.*; for goods received in March 121*l.* 17*s.*; for goods received in April 142*l.* 15*s.* 4*d.*; for goods received in May 171*l.* 15*s.* 10*d.*; for goods received in June 142*l.* 12*s.* 6*d.* but the latter ſix months of the year, owing to the falling off in the demands for the articles in which he dealt, amounted to the ſum only of 205*l.* 7*s.* 2*d.* I deſire to know the amount of the whole year's bill?

Anſ. £981 : 3 : 4.

SUBTRACTION

SUBTRACTION *of* MONEY, WEIGHTS, *and* MEASURES.

RULE. Subtract as in integers; only when any of the lower denominations are greater than the upper, borrow as many of that as make one of the next ſuperior, adding it to the upper, from which take the leſs; ſet down the difference, and carry 1 to the next higher denomination for what you borrowed.

PROOF. As in Integers.

MONEY.

	£.	s.	d.
Borrowed	715	2	7¼
Paid	476	3	8½
Remains to pay	238 :	18 :	10¾
Proof	715 :	2 :	7¼

	£.	s.	d.
Lent	316	3	5½
Received	218	2	1¾

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
87	2	10	3	15	1½	25	2	5¼	37	3	4¼
79	3	7¼	1	14	7	17	9	8½	27	5	2¼
321	17	1½	59	15	3½	71	2	4	527	3	5½
257	14	7	36	17	2	19	13	7¼	139	5	7½

Borrowed	25107	15	7
	375	5	5¼
Paid	259	2	7½
at	359	13	4¾
different	523	17	3
times	274	15	7¼
	425	13	5
Paid in all			
Remains to pay			

Lent	25156	1	6
	271	13	7¼
Received	359	15	3
at	475	13	9¾
ſeveral	527	15	3¾
payments	272	16	5
	150	—	—

TROY WEIGHT.

	oz.	*dt.*	*gr.*	*oz.*	*dt.*	*gr.*	*lb.*	*oz.*	*dt.*	*gr.*	*lb.*	*oz.*	*dt.*	*gr.*
Bought	27	15	2	7	5	15	52	1	7	2	7	2	2	5
Sold	21	14	7	6	7	14	39	–	15	7	5	7	1	7
Unſold														

AVOIRDUPOISE WEIGHT.

lb.	*oz.*	*dr.*	*lb.*	*oz.*	*dr.*	*cwt.*	*qrs.*	*lb.*	*T.*	*cwt.*	*qr.*	*lb.*
25	11	15	35	10	5	35	1	21	21	1	2	7
17	9	13	29	12	7	25	1	10	9	1	3	5

APOTHECARIES WEIGHT.

℥	ʒ	℈	*gr.*	℥	ʒ	℈	*gr.*	℔	℥	ʒ	℈	℔	℥	ʒ	℈
27	1	–	1	3	1	2	4	5	2	1	–	9	7	2	1
15	2	–	7	1	–	–	7	2	5	2	1	6	7	3	1

CLOTH MEASURE.

FE.	*qrs.*	*n.*	*yds.*	*qrs.*	*n.*	*yds.*	*qrs.*	*n.*	*EE.*	*qrs.*	*n.*
35	2	2	47	1	–	71	1	2	35	2	1
17	2	1	35	2	2	3	2	1	14	3	2

LONG MEASURE.

f.	*in.*	*bar.*	*yds.*	*f.*	*in.*	*m.*	*fur.*	*p.*	*l.*	*m.*	*f.*	*p.*
25	1	–	37	2	1	52	1	27	71	1	7	—
17	2	2	15	2	7	25	7	34	50	–	3	27

LAND MEASURE.

a.	*r.*	*p.*	*a.*	*r.*	*p.*	*a.*	*r.*	*p.*	*a.*	*r.*	*p.*
75	1	27	37	1	27	25	–	1	325	2	1
59	–	27	35	2	15	17	1	–	279	3	5

WINE MEASURE.

tun.	*gal.*	*qts.*	*tier.*	*gal.*	*qts.*	*hhds.*	*gal.*	*qts.*	*tun*	*hhd.*	*gal.*
72	1	1	27	27	1	75	57	1	79	2	14
35	1	2	19	35	2	57	59	1	35	3	27

ALE and BEER MEASURE.

AB.	*fir.*	*gal.*	*BB.*	*fir.*	*gal.*	*hhds.*	*gal.*	*qts.*	*hhd.*	*gal.*	*qt.*
25	1	2	37	2	1	27	27	1	709	2	2
21	1	5	25	1	7	12	50	2	157	2	2

DRY MEASURE.

qu.	*bu.*	*p.*	*qu.*	*bu.*	*p.*	*ch.*	*bu.*	*p.*	*ch.*	*bu.*	*p.*
72	1	3	65	2	1	79	3	–	35	3	3
35	2	3	57	2	3	54	7	1	23	5	1

TIME.

h.	*m.*	"	*d.*	*h.*	*m.*	*m.*	*w.*	*d.*	*m.*	*w.*	*d.*
75	1	27	72	1	51	35	2	1	65	2	1
52	7	31	36	3	27	17	3	5	14	1	1

The APPLICATION.

1. A man born in the year 1723; What was his age in the year 1796? *Anſ.* 73.

2. What is the difference between the age of a man born in 1710, and another born in 1766? *Anſ.* 56.

3. A merchant had 5 debtors, A, B, C, D, and E; which together owed him 1156*l.*; B, C, D, and E, owed him 737*l.*—What was A's debt. *Anſ.* £419.

4. When an eſtate of 300*l.* *per annum* is reduced, on paying of taxes, to 12 ſcore 14*l.* 6*s.*—What is the tax? *Anſ.* £45 : 14.

5. What is the difference between 9154, and the amount of 754 added to 305? *Anſ.* 8095.

6. A horſe in his furniture is worth 37*l.* 5*s.* out of it 14 guineas: How much does the price of the furniture exceed that of the horſe? *Anſ.* £7 : 17*s.*

7. A merchant at his out-ſetting in trade, owed 750*l.* he had in caſh, commodities, the ſtocks, and good debts 12510*l.* 7*s.*; he cleared the firſt year by commerce, 452*l.* 3*s.* 6*d.*—What was the neat balance at the twelve months end? *Anſ.* £12212 : 10*s.* : 6*d.*

8. A gentleman dying left 45247*l.* between two daughters; the youngeſt was to have 15 thouſand, 15 hundred, and twice 15*l.* What was the eldeſt ſiſter's fortune? *Anſ.* £28717.

9. A, B, C, and D, ſent their money to the banker's, and drew upon him in this manner: Jan 3, 1794, A ſent in 152*l.* 12*s.*; B had 132*l.* 15*s.* 2*d.* good in the banker's hands, and on the 10th ſent in 52*l.* 12*s.* 6*d.* more; C, after taking out 100*l.* found he had left in the banker's hands 173*l.* 8*s.* 4*d.* and on the 6th added 175*l.* to his ſtock. The day following, D made up his ſtock, 172*l.* 12*s.* 6*d.* and on the 10th drew for 121*l.* 6*s.* 2*d.* On the 12th, A drew for 119*l.* 12*s.* 3*d.* and ſent in good bills to the amount of 171*l.* 11*s.* 5*d.* The ſame day B drew for 142*l.* 14*s.* 6*d.* as did C for 205*l.* 10*s.* On the 20th D ſent in 128*l.* 12*s.* 4*d.* and the next day drew for 93*l.* 15*s.* 2*d.* On the 30th they drew 20 guineas each, and in the afternoon ſent in 30 gui-

neas each. I deſire to know how their accounts ſtood ſeparately with the banker?

Anſ. A. had left in the banker's hands £215 : 1 : 2.
B £53 : 3 : 2.—*C* £153 : 8 : 4 —*D* £66 : 13 : 6.

10. A tradeſman happening to fail in buſineſs, called all his creditors together, and found he owed to A 53 . 7 . . 6*d.*; to B 105*l.* 10*s.*; to C 34*l.* 5*s.* 2*d.*; to D 28*l.* 16*s.* 5*d.*; to E 14*l.* 15*s.* 8*d.*; to F 112*l.* 9*s.*; and to G 143*l.* 12*s.* 9*d.* His creditors found the value of his ſtock to be 212*l.* 6*s.* and that he had owing him in good book debts 112*l.* 8*s.* 3*d.* beſides 21*l.* 10*s.* 5*d.* money in hand. As his creditors took all his effects into their hands, I deſire to know whether they were loſers or gainers, and how much?

The creditors loſt £146 : 1 : 10.

11. My correſpondent, at Seville, in Spain, ſends me the following account of money received at different ſales for goods ſent him by me, viz. Bees-wax to the value of 37*l.* 15*s.* 4*d.*; ſtockings 37*l.* 6*s.* 7*d.*; tobacco 125*l.* 11*s.* 6*d.*; linen cloth 112*l.* 14*s.* 8*d.*; tin 115*l.* 10*s.* 5*d.* My correſpondent at the ſame time informs me, that he has ſhipped, agreeable to my order, wines to the value of 250*l.* 15*s.*; fruit to the value of 51*l.* 12*s.* 6*d.*; figs 19*l.* 17*s.* 6*d.*; oil 19*l.* 12*s.* 4*d.*; and Spaniſh wool to the value of 115*l.* 15*s.* 6*d.* I deſire to know how the account ſtands between us, and who is the debtor? *Anſ. Due to my Spaniſh correſpondent* £26 : 14 : 4.

MULTIPLICATION *of ſeveral* DENOMINATIONS.

RULE. Multiply the firſt denomination by the quantity given, dividing the product by as many of that as make one of the next, ſetting down the remainder, and add the quotient to the next ſuperior, after it is multiplied.

If the given quantity is above 12, multiply by any two numbers, which multiplied together will make the ſame number; but if no two numbers multiplied together will make the exact number, then multiply the top line by as many as is wanting, adding it to the laſt product.

PROOF. By Diviſion.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
35	12	$7\frac{1}{4}$	75	13	$1\frac{1}{2}$	62	5	$4\frac{1}{4}$	57	2	$4\frac{3}{4}$
		2			3			4			5
71	5	$2\frac{1}{2}$									

lb.	*oz.*	*dwt.*	*gr.*
8	5	17	4
			7

ton.	*cwt.*	*qrs.*	*lb.*
25	7	2	1
			8

yds.	*qrs.*	*n.*
76	1	2
		2

m.	*fur.*	*p.*
36	7	5
		5

a.	*r.*	*p.*
7	2	1
		9

A.B.	*fir.*	*gal.*
32	1	7
		7

B.B.	*fir.*	*gal.*
26	2	7
		3

m.	*fur.*	*p.*
54	2	1
		5

1. 18 yds. of cloth at 9*s.* 6*d.* *per* yd.

9 × 2 = 18

	9	6
		9
4	5	6
		2
8	11	–

2. 26lb. of tea, at £1 2 6 *per* lb.

8 × 3 + 2 = 26

	£1	2	6
			8
	9	–	–
			3
	27	–	–
Top line × 2 =	2	5	–
	29	5	–

3. 21 ells of Holland, at 7*s.* 8½*d.* *per* ell,
Facit £8 : 1 : 10½.

4. 34 firkins of butter, at 15*s.* 3½ *per* firkin,
Facit £27 : 2 : 2½.

5. 75lb. of nutmegs, at 7*s.* 2¾*d.* *per* lb.
Facit £27 : 2 : 2¼.

6. 37 yards of tabby, at 9*s.* 7*d.* *per* yard,
Facit £17 : 4 : 7.

7. 97 cwt. of cheeſe, at 1*l.* 5*s.* 3*d.* *per* cwt.
Facit £122 : 9 : 3.

8. 43 doz. of candles, at 6*s.* 4*d.* *per* dozen,
Facit £13 : 12 : 4.

9. 127lb. of bohea, at 12*s.* 3*d.* *per* lb.
Facit £77 : 15 : 9.

10. 135 gallons of rum, at 7*s.* 5*d.* *yer* gallon,
Facit £50 : 1 : 3.

11. 74 ells of diaper, at 1*s.* 4½*d.* *per* ell,
Facit £5 : 1 : 9.

12. 6 doz. pair of gloves, at 1*s.* 10*d.* *per* pair,
Facit £6 : 12*s.*

When the given quantity conſiſts of ½, ¼, divide the price by ½, ¼, when ¾, divide the price by ½, and that quotient by ½; which add to the product of the quantity given.

13. 25½ of Holland, at 3*s.* 4½ *per* ell.

5 5×5=25

16 : 10½

5

4 : 4 : 4½=25

– : 1 : 8¼= ½

4 : 6 : –¾=25½

14. 75½ ells of diaper, at 1*s.* 3*d.* *per* ell,
Facit £4 : 14 : 4½.

15. 19½ ells of damaſk, at 4*s.* 3*d.* *per* ell,
Facit £4 : 2 : 10½.

16. 35¼ ells of dowlas, at 1*s.* 4*d.* *per* ell,
Facit £2 : 7 : 4.

17. 7¼ cwt. of Malaga raiſins, at 1*l.* 1*s.* 6*d.* *per* cwt.
Facit £7 : 15 : 10½.

18. 6½ barrels of herrings, at 3*l.* 15*s.* 7*d.* *per* barrel,
Facit £24 : 11 : 3½.

19. 35½ cwt. of double refined ſugar at 4*l.* 15*s.* 6*d.* *per* cwt.
Facit £169 : 10 : 3.

20. 154½ 154 cwt. of tobacco, at 4*l.* 17*s.* 10*d.* *per* cwt.
Facit £755 : 15 : 3.

21. 117¼ gallons of arrac, at 12*s.* 6*d.* *per* gallon,
Facit £73 : 5 : 7½.

22. 85¾ cwt. of cheeſe, at 1*l.* 7*s.* 8*d.* *per* cwt.
Facit £118 : 12 : 5.

23. 29¼ lb. of fine hyſon tea, at 1*l.* 3*s.* 6*d.* *per* lb.
Facit £34 : 7 : 4¼.

24. 17¾ yds. of ſuperfine ſcarlet drab, at 1*l.* 3*s.* *per* yard,
Facit £20 : 17 : 1½.

25. 37½ yds. of rich brocaded ſilk, at 12*s.* 4*d.* *per* yard,
Facit £23 : 2 : 6.

26. 56¾ cwt. of ſugar, at 2*l.* 18*s.* 7*d.* *per* cwt.
Facit £166 : 4 : 7¼.

27. 96½ cwt. of currans, 2*l.* 15*s.* 6*d.* *per* cwt.
Facit £267 : 15 : 9.

28. 45¾ lb. of Balladine ſilk, at 18*s.* 6*d.* *per* lb.
Facit £42 : 6 : 4½.

29. 87¾ buſhels of wheat, at 4*s.* 3*d.* *per* buſhel,
Facit £18 : 12 : 11¼.

30. 120½ cwt of hops, at 4*l.* 7*s.* 6*d.* *per* cwt.
Facit £528 : 5 : 7¼.

The APPLICATION.

1. What ſum of money muſt be divided amongſt 18 men, ſo that each may receive 14*l.* 6*s.* 8½*d*? *Anſ* £258 : 0 : 9.

2. A privateer of 250 men took a prize, which amounted to 125*l.* 15*s.* 6*d.* to each man—what was the value of the prize? *Anſ.* £31443 : 15*s.*

3. What is the difference between 6 dozen dozen, and half a dozen dozen—and what is their ſum and product?
Anſ. diff. 792, *ſum* 936, *product* 62208.

4. What difference is there between twice eight and fifty, and twice fifty-eight—and what is their product?
Anſ. diff. 50; *prod.* 7656.

5. There are two numbers, the greater of them is 37 times 45, and their difference 19 times 4; their ſum and product are required. *Anſ. ſum* 3254; *prod.* 2645685.

6. The ſum of two numbers is 360, the reſt of them 144—what is their product, and the ſquare of their difference?
Anſ. product 31104, *ſquare of their difference* 5184.

7. In an army, conſiſting of 187 ſquadrons of horſe, each 157 men, and 207 battalions, each 560 men—how many effective ſoldiers, ſuppoſing that in 7 hoſpitals there are 473 ſick? *Anſ.* 144806.

8. What ſum did that gentleman receive in dowry with his wife, whoſe fortune was her wedding-ſuit; her petticoat having two rows of furbelows, each furbelow 87 quills, and each quill 21 guineas? *Anſ.* £3836 : 14*s.*

9. A merchant had 19118*l.* to begin trade with: For 5 years together he cleared 1086*l.* a-year; the next 4 years he made good 2715*l.* 10*s.* 6*d.* a-year; but the laſt 3 years he was in trade, had the misfortune to loſe one year with another, 475*l.* 4*s.* 6*d.* a-year—what was his real fortune at 12 years end? *Anſ.* £33984 : 8 : 6.

10. In ſome parts of the kingdom they weigh their coals by a machine, in the nature of a ſteel-yard, waggon and all. Three of theſe draughts together amount to 137 cwt. 2 qrs. 10lb. and the tare or weight of the waggon 13 cwt. 1 qr. How many coals had the cuſtomer in twelve ſuch draughts.
Anſ. 391 *cwt.* 1 *qr.* 12*lb.*

11. A certain gentleman lays up every year 294*l.* 12*s.* 6*d.* and ſpends daily 1*l.* 12*s.* 6*d.* I deſire to know what is his annual income? *Anſ.* £887 : 15*s.*

12. A tradeſman gave to his daughter as a marriage portion a ſcrutoire, in which were twelve drawers, in each drawer were ſix diviſions, and in each diviſion there were 50*l.* four crown pieces, and eight half crown pieces. How much had ſhe to her fortune? *Anſ.* £3744.

13. Admitting that I pay eight guineas and half a crown for a quarter's rent, and am allowed quarterly 15*s.* for trifling repairs, what does my apartment coſt me annually and how much in ſeven years?

Anſ. In one year £31 : 2*s.* *In ſeven* £217 : 14*s.*

14. A robbery being committed on the highway, an aſſeſſment was made on a neighbouring hundred for the ſum of 386*l.* 15*s.* 6*d.* of which four pariſhes paid each 37*l.* 14*s.* 2*d.* four hamlets 31*l.* 4*s.* 2*d.* each, and the four townſhips 18*l.* 12*s.* 6*d.* each. How much was the deficiency?

Anſ. £36 : 12 : 2.

15. A gentleman at his deceaſe left his widow 4560*l.*; to a public charity he bequeathed 572*l.* 10*s.* to each of his four nephews 750*l.* 10*s.*; to each of his four nieces 375*l.* 12*s.* 6*d.*; to 30 poor houſekeepers ten guiueas each, and 150 guineas to his executor. What ſum muſt he have been poſſeſſed of at the time of his death to anſwer all theſe legacies? *Anſ.* £10107 : 10*s.*

16. Admit 20 to be the remainder of a diviſion ſum, 423 the quotient, the diviſion the ſum of both, and 19 more. What was the number of the dividend? *Anſ.* 195446.

DIVISION *of ſeveral* DENOMINATIONS.

RULE. Divide the firſt denomination on the left hand; and, if any remains, multiply them by as many of the next leſs as make one of that, which add to the next, and divide as before. PROOF, by Multiplication.

£. s. d.	*£. s. d.*	*£. s. d.*	*£. s. d.*
2)25 : 2 : 4(	3)37 : 7 : 7(	4)57 : 5 : 7(	5)52 : 7 : 0(
12 : 11 : 2			

lb. oz. dwt. gr.	*lb. oz. dr.*	*T. cwt. qrs. lb.*
6)75 : 3 : 7 : 5(	7)35 : 14 : 13(	8)5 : 10 : 1 : 13(
yds. qrs. n.	*m. f. p.*	*yds. ft. in.*
9)35 : 1 : 3(	10)76 : 3 : 27(	11)75 : 2 : 9(
A.B. fir. gal.	*A.B. fir. gal.*	*ch. bu. pk.*
12)35 : 2 : 5(	13)55 : 3 : 7(	14)357 : 2 : 1(

The APPLICATION.

1. If a man ſpends 257*l.* 2*s.* 5*d.* in 12 months time: What is that *per* month? *Anſ.* £21 : 8 : 6½.

2. The clothing of 35 charity boys came to 57*l.* 3*s.* 7*d.* What is the expence of each? *Anſ.* £1 : 12 : 8.

3. If I give 37*l.* 6*s.* 4¾*d.* for 9 pieces of cloth: What did I give *per* piece? *Anſ.* £4 : 2 : 11.

4. If 20 cwt. of tobacco came to 27*l.* 5*s.* 4½*d.* At what rate is that *per* cwt? *Anſ.* £1 : 7 : 3.

5. What is the value of 1 hogſhead of beer, when 120 are ſold for 154*l.* 17*s.* 10*d.* *Anſ* £1 : 5 : 9¾.

6. Bought 72 yards of cloth for 85*l.* 6*s.* I deſire to know at what rate *per* yard? *Anſ.* £1 : 3 : 8¼.

7. Gave 275*l.* 3*s.* 4*d.* for 36 bales of cloth: What is that for 2 bales? *Anſ.* £15 : 5 : 8¾.

8. A prize of 7257*l.* 3*s.* 6*d.* is to be equally divided among 500 ſailors: what is each man's ſhare?

Anſ. £14 : 10 : 3¼.

9. There are 2545 bullocks to be divided among 509 men: I deſire to know how many each man had, and the value of each man's ſhare, ſuppoſing every bullock worth 9*l.* 14*s.* 6*d.*

Anſ. 5 *bullocks each man*; £48 : 12 : 6. *each ſhare.*

10. A gentleman has a garden walled in, containing 9625 yards, the breadth was 35 yds. What was the length?

Anſ. 275.

11. A club in London, conſiſting of 25 gentlemen, joined for a lottery-ticket of 10*l.* value, which came up a prize of 4000*l.* I deſire to know what each man contributed, and what each man's ſhare came to?

Anſ. each man contributed 8*s.*; *each ſhare* 160*l.*

12. A trader cleared 1156*l.* equally in 17 years: How much did he lay by in a year? *Anſ.* £68.

13. Another cleared 2805*l.* in 7½ years: What was his yearly increaſe of fortune? *Anſ.* £374.

14. What number added to the 43d part of 4429 will raiſe it to 240? *Anſ.* 137.

15. Divide 20*s.* between A, B, and C, in ſuch ſort that A may have 2*s.* leſs than B, and C 2*s.* more than B.

Anſ. A, 4*s.* 8*d.*; *B*, 6*s.* 8*d.*; **C**, 8*s.* 8*d.*

16. If there are 1000 men to a regiment, and but 50 officers: How many private men are there to one officer? *Anſ.* 19.

17. What number is that, which, multiplied by 7847, will make the product 3013248? *Anſ.* 384.

18. The quotient is 1083, the diviſor 28604: What was the dividend, if the remainder came out 1788? *Anſ.* 30979920.

19. An army, conſiſting of 20,000 men, took and plundered a city of 12,000*l.* What was each man's ſhare, the whole being equally divided among them? *Anſ.* 12*s.*

20. My purſe and money, ſaid Dick to Harry, are worth 12*s.* 8*d.* but the money is worth ſeven times the purſe. What did the purſe contain? *Anſ.* 11*s.* 1*d.*

21. A merchant bought two lots of tobacco, which weighed 12 cwt. 3 qrs. 15 lb. for 14*l.* 15*s.* 6*d.* The difference in point of weight was 1 cwt. 2 qrs. 13 lb. and of price 7*l.* 15*s.* 6*d.* I deſire to know their reſpective weights and value?
Anſ. Leſſer weight 5 *cwt.* 2 *qrs.* 15*lb.* *Price* £53 : 10*s.*
Greater weight 7 *cwt.* 1 *qr.* *Price* £61 : 5 : 6.

22. The Spectator mentions a club of fat people, whoſe number was only fifteen, and yet weighed no leſs than three tons. What was the weight of each perſon? *Anſ.* 4 *cwt.*

23. Five auditors in a public office receive ten pounds a quarter, for which they attend ſeven times during that period; but, if one or more of them be abſent at any time, then the abſent perſons' ſhares are divided among thoſe who attend. A and B never miſs attendance on theſe occaſions; but C and D are generally abſent twice in a quarter, and E once. When the payment comes due, I wiſh to know what each has to receive?
Anſ. A £2 : 9 : $0\frac{4}{7}$; *B* £2 : 9 : $0\frac{4}{7}$; *C* £1 : 10*s.*;
D £1 : 10*s.*; *E* £2 : 1 : $10\frac{6}{7}$.

24. Divide 1000 crowns in ſuch a manner between A, B, and C, that A may receive 129 more than B, and B 178 leſs than C. *Anſ. A* 360, *B* 231, *C* 409.

25. A young fellow owed his guardian 74*l.* 18*s.* 2*d.* on balance. He paid off 41*l.* 14*s.* 8*d.* and than declared that his ſiſter owed the gentleman half as much again as himſelf. Being told of this circumſtance, ſhe pays off in part 13*l.* 12*s* 10*d.* and gives out that her uncle Joſeph was not leſs

in arrears than her brother and ſhe together. In conſequence of this the uncle pays in 24*l.* 7*s.* 3*d.* and then the uncle's brother, who, by the bye, was not the uncle of thoſe children, for 150*l.* undertakes to ſet them all clear, and has 35*l.* 15*s.* 5*d.* to ſpare, according to his account, I deſire to know whether this be true or not?

26. Three boys met a ſervant maid carrying apples to the market. The firſt took half what ſhe had, but returned her ten: the ſecond took one third, but returned two; and the third took away half thoſe ſhe had left, but returned her one. She had then twelve apples left: how many had ſhe at firſt? *Anſ.* 40.

BILLS *of* PARCELS.

HOSIERS.

Mr. John Thomas

Bought of Samuel Green, March 7, 1796.

			s.	*d.*		
8	Pair of worſted ſtockings	at	4	6	*per* pair	£
5	Pair of thread ditto	at	3	2	——	
3	Pair of black ſilk ditto	at	14	0	——	
6	Pair of milled hoſe	at	4	2	——	
4	Pair of cotton	at	7	6	——	
2	Yards of fine flannel	at	1	8	*per* yard	£
						£7 : 12 : 2

MERCERS.

Mr. Iſaac Grant

Bought of John Sims, March 12, 1796.

			s.	*d.*		
15	Yards of ſatin	at	9	6	*per* yard	£
18	Yards of flowered ſilk	at	17	4	——	
12	Yards of rich brocade	at	19	8	——	
16	Yards of ſarſenet	at	3	2	——	
13	Yards of Genoa velvet	at	27	6	——	
23	Yards of luſtring	at	6	3	——	
						£62 : 2 : 5

LINEN-DRAPERS.

Mr. Simon Surety

Bought of Joſiah Short, March 27, 1796.

			s.	d.		
4	Yards of cambric	at	12	6	*per* yard	£
12	Yards of muſlin	at	8	3	——	
15	Yards of printed linen	at	5	4	——	
2	Dozen of napkins	at	2	3	each	
14	Ells of diaper	at	1	7	*per* ell	
35	Ells of dowlas	at	1	1½	——	

£17 : 4 : 6½

MILLINERS.

Mrs. Bright,

Bought of Lucy Brown, April 5, 1796.

			s.	d.		
18	Yards of fine lace	at	12	3	*per* yard	£
5	Pair of fine kid gloves	at	2	2	*per* pair	
4	Dozen of Iriſh lamb ditto	at	1	3	——	
12	Fans and French mounts	at	3	6	each	
2	Fine laced tippets	at	63	0		
6	Sets of knots	at	2	6	*per* ſet	

£23 : 14 : 4

WOOLLEN-DRAPERS.

Mr. Thomas [illegible]age

Bought of Ellis Smith, April 7, 1796.

			s.	d.		
17	Yards of fine ſerge	at	3	9	*per* yard	£
18	Yards of drugget	at	9	0	——	
15	Yards of ſuperfine ſcarlet	at	22	0	——	
16	Yards of black cloth	at	18	0	——	
25	Yards of ſhalloon	at	1	9	——	
17	Yards of drab cloth	at	17	6	——	

£59 : 5 : 0

LEATHER-

LEATHER-SELLERS.

Mr. Giles Harris

Bought of Abel Smith, April 15, 1796.

			s.	d.		
27	Calf ſkins	at	3	9	*per* ſkin	£
75	Sheep ditto	at	1	7	——	
36	Coloured ditto	at	1	8	——	
15	Buck ditto	at	11	6	——	
17	Ruſſia hides	at	10	7	each	
120	Lamb ſkins	at	1	2½	*per* ſkin.	

£38 : 17 : 5

GROCERS.

Mr. Richard Groves

Bought of Francis Elliot, April, 21, 1796.

			s.	d.		
25	lb of lump ſugar	at	0	6½	*per* lb.	£
2	Loaves of double-refined, weight 15 lb.	at	0	11½	——	
14	lb of rice	at	0	3	——	
28	lb of Malaga raiſins	at	0	5	——	
15	lb of currants	at	0	5½	——	
7	lb of black pepper	at	1	10	——	

£3 : 2 : 9½

CHEESE-MONGERS.

Mr. Charles Croſs

Bought of Samuel Grant, April 23, 1796.

			s.	d.		
8	lb of Cambridge butter	at	0	6	*per* lb.	£
17	lb of new cheeſe	at	0	4	——	
½	Firkin of butter wt. 28lb	at	0	5½	——	
5	Cheſhire cheeſes, wt. 127lb	at	0	4	——	
2	Warwickſhire do. wt. 15lb	at	0	3	——	
22	lb of cream cheeſe	at	0	6	——	

£3 : 14 : 7

CORN-CHANDLER.

Mr. Abraham Doyley

Bought of Iſaac Jones, April 29, 1796.

			s	d.		£
Tares,	19 buſhels	at	1	10	*per* buſhel	
Peas,	18 buſhels	at	3	9½	——	
Beans,	12 buſhels	at	4	8	——	
Oats,	6 quarters	at	2	4	——	
Malt,	7 quarters	at	25	0	*per* quarter	
Hops,	15 lb.	at	1	5	*per* lb.	
						£23 : 7 : 4

REDUCTION.

IS the bringing or reducing numbers of one denomination into other numbers of another denomination, retaining the ſame value, and is performed by Multiplication and Diviſion.

Firſt, All great names are brought into ſmall, by multiplying with ſo many of the leſs as make one of the greater.

Secondly, All ſmall names are brought into great, by dividing with ſo many of the leſs as to make one of the greater.

A TABLE *of ſuch* COINS *as are current in* ENGLAND.

	l.	*s.*	*d.*
Guinea	1	1	0
Half ditto	0	10	6
Crown	0	5	0
Half ditto	0	2	6
Shilling	0	0	12

☞ *There are ſeveral pieces which ſpeak their own value; ſuch as ſix-pence, four-pence, three-pence, two-pence, penny, half-penny, farthing.*

REDUCTION *Deſcending.*

1. In 8*l.* how many ſhillings and pence?

20

160 *ſhillings.*

12

1790 *pence.*

2. In 12*l.*—how many ſhillings, pence, and farthings?

Anſ. 240*s.*; 2880*l.*; 11520 *far.*

3. How many ſhillings, pence, and farthings are there in 18*l.* *Anſ.* 360*s.*; 4320*d.*; 17280 *far.*

4. Reduce 7*l.* and a crown into ſhillings and pence.

Facit 145*s.*; 1740*d.*

5. How many farthings are there in 21 guineas?

Anſ. 21168.

6. In 17*l.* 5*s.* 3¼*d.*—how many farthings? *Anſ.* 16573.

7. In 25*l.* 14*s.* 1*d.*—how many ſhillings and pence?

Anſ. 514*s.*; 6169*d.*

8. In 15 crowns—how many ſhillings and ſixpences.

Anſ. 75*s.*; 150 *ſixpences.*

9. How many crowns and ſhillings in 25*l.*?

Anſ. 100 *crowns*, 500*s.*

10. In 57 half crowns—how many pence and farthings?

Anſ. 1710*d.*; 6840 *farthings.*

11. In 52 crowns, as many half-crowns, ſhillings and pence--how many farthings? *Anſ.* 21424.

12. How many half-crowns, ſix-pences, and three-pences are there in 75*l.*

Anſ. 600 *half-crowns*; 3000 *ſix-pences*; 6000 *three-pences.*

REDUCTION *Aſcending.*

13. In 1920 pence, how many ſhillings and pounds?

Anſ. 160*s.*; 8*l.*

12)1920

2|0)16|0(*ſhillings.*

8 *pounds.*

14. In 11520 farthings, how many pence, ſhillings, and pounds? *Anſ.* 2880*d.*; 240*s.*; 12*l.*

15. How many pence, ſhillings, and pounds, are there in 17280 farthings? *Anſ.* 4320*d.*; 360*s.*; 18*l.*

16. Reduce 1740 pence into ſhillings and pounds? *Facit* 145*s.*; £7 : 5*s.*

17. How many guineas in 21168 *farthings*? *Anſ.* 21*g.*

18. In 16573 farthings—how many pounds? *Anſ.* £17 : 5 : 3¼.

19. In 6169 pence—how many ſhillings and pounds? *Anſ.* 514*s.*; £25 : 14 : 1.

20. In 900 pence—how many ſhillings and crowns? *Anſ.* 75*s.*; 15 *crowns.*

21. How many crowns and pounds in 500 ſhillings? *Anſ.* 100 *crowns*; 25*l.*

22. In 6840 farthings—how many pence and half-crowns? *Anſ.* 1710*d.*; 57 *half-crowns.*

23. In 21424 farthings—how many crowns, half-crowns, ſhillings, and pence, and of each an equal number? *Anſ.* 52.

24. How many ſixpences, half-crowns, and pounds, in 6000 three-pences? *Anſ.* 3000 *ſixpences*; 600 *half-crowns*; 75*l.*

ASCENDING *and* DESCENDING.

25. In 1560 pence—how many crowns and ſhillings? *Anſ.* 26 *crowns*; 130*s.*

```
6|0)156|0
    -----
       26
        5
    -----
      130
    =====
```

26. Reduce 130 ſhillings into crowns and pence? *Facit* 26 *crowns*; 1560*d.*

27. How many ſhillings, crowns, and pounds in 60 guineas? *Anſ.* 1260*s.*; 252 *crowns*; 63*l.*

28. In 63*l.*—how many crowns, ſhillings, and guineas? *Anſ.* 252 *crowns*; 1260*s.*; 60 *guineas.*

29. Reduce 76 moidores into ſhillings and pounds? *Facit* 2052*s.*; £102 : 12*s.*

30. Reduce 102*l.* 12*s.* into ſhillings and moidores? *Facit* 2052*s.*; 76 *moidores.*

31. How many ſhillings, half-crowns, and crowns, are there in 556*l.* and of each an equal number?

Anſ. 1308 *each*, and 2*s.* *over.*

32. In 1308 half-crowns, as many crowns and ſhillings, how many pounds? *Anſ.* £555 : 18*s.*

33. Seven men brought 15*l.* 10*s.* each into the mint, to be changed into guineas—how many muſt they have in all?

Anſ. 103 *guineas*, 7*s.* *over.*

34. If 103 guineas and 7 ſhillings are to be divided amongſt 7 men—how many pounds ſterling is that to each?

Anſ. £15 : 10*s.*

35. A certain perſon had 25 purſes, and in each purſe 12 guineas, a crown, and a moidore—how many pounds ſterling had he in all? *Anſ.* 355.

36. A gentleman, in his will leaves 50*l.* to the poor, and ordered that $\frac{1}{3}$ ſhould be given to ancient men, each to have 5*s.*—$\frac{1}{4}$ to poor women, each to have 2*s.* 6*d.*;—$\frac{1}{5}$ to poor boys, each to have 1*s.*;—$\frac{1}{8}$ to poor girls, each to have 9*d.*; and the remainder to the perſon that diſtributed it:—I demand how many of each ſort there were, and what the perſon that diſtributed the money had for his pains?

Anſ. 66 *men*, 100 *women*, 200 *boys*, 222 *girls*, £2 : 13 : 6. *to the perſon.*

TROY WEIGHT.

37. In 27 ounces of gold—how many grains?

Anſ. 12960.

38. In 12960 grains of gold—how many ounces?

Anſ. 27.

39. In 3 lb. 10 oz. 7 dwts. 5 gr.—how many grains?

Anſ. 22253.

40. In 8 ingots of ſilver, each weighing 7 lb. 4 oz. 17 dwts. 15 gr—how many ounces, pennyweights, and grains? *Anſ.* 711 *oz.*; 14221 *dwt.*; 341304 *gr.*

41. How many ingots of 7 lb. 4 oz. 17 dwt. 15 gr. each are there in 341304 grains? *Anſ.* 8 *ingots.*

42. Bought 7 ingots of ſilver, each containing 23 lb. 5 oz. 7 dwt.—how many grains: *Anſ.* 945336.

43. A gentleman ſent a tankard to his goldſmith that weighed 50 oz. 8 dwt. and ordered him to make it into ſpoons, each to weigh 2 oz. 16 dwt.—how many had he?

Anſ. 18.

44. A gentlemen delivered to a goldſmith 137 oz. 6 dwt. 9 gr. of ſilver, and ordered him to make it into tankards of 17 oz. 15 dwts. 10 gr. each; ſpoons of 21 oz. 11 dwt. 13 gr. *per* dozen; ſalts at 3 oz. 10 dwt. each; and forks at 21 oz. 11 dwt. 13 gr. *per* dozen; and for every tankard to have one ſalt, a dozen of ſpoons, and a dozen of forks.—What is the number of each he muſt have?

Anſ. two of each ſort; 8 oz. 9 dwt. 9 gr. over.

AVOIRDUPOISE WEIGHT.

Note, *There are ſeveral ſorts of ſilk which are weighed by a great pound of 24 oz. others by the common pound of 16 oz. therefore,*

To bring great pounds into common, multiply by 3, and divide by 2, or add one half.

To bring ſmall pounds into great, multiply by 2, and divide by 3, or ſubtract one third.

Things bought and ſold by the tale.

Dozen.		*Paper and Parchment.*	
12 Pieces or things make	1 doz.	24 Sheets make	1 quire.
12 Dozen —	1 groſs	20 Quires —	1 ream.
12 Groſs, or 144 doz.	1 great groſs	2 Reams —	1 bund.
		1 Doz. of par.	12 ſkins.
		12 Skins —	1 roll.

45. In 14769 ounces—how many cwt.?

Anſ. 8 *cwt.* 27 *lb.* 1 *oz.*

46. Reduce 8 cwt. 27 lb. 1 oz. into quarters, pounds, and ounces. *Anſ.* 32 *qrs.* 923 *lb.* 14769 *oz.*

47. Bought 32 bags of hops, each 2 cwt. 1 qr. 14 lb. and another of 150 lb.—How many cwt. in the whole?

Anſ. 77 *cwt.* 1 *qr.* 10 *lb.*

48. In 34 ton, 17 cwt. 1 qr. 19 lb.—how many pounds?

Anſ. 78111.

49. In 350 great pounds—how many common? *Anſ* 525.

50. In 27 cwt. of raiſins—how many parcels of 18 lb. each? *Anſ.* 168.

51. In 9 cwt. 2 qrs. 14 lb. of indigo—how many pounds?

Anſ. 1078.

52. In 547 great pounds—how many common pounds?

Anſ. 820 *lb.* 8 *oz.*

53. Bought 27 bags of hops, each 2 cwt. 1 qr. 15 lb. and 1 bag of 137 lb.—how many hundreds in the whole? *Anſ.* 65 *cwt.* 2 *qrs.* 10 *lb.*

54. How many pounds in 27 hogſheads of tobacco, each weighing neat $8\frac{3}{4}$ cwt.? *Anſ.* 26460.

55. In 552 common pounds of ſilk—how many great pounds? *Anſ.* 368.

56. How many parcels of ſugar of 16 lb. 2 oz. are there in 16 cwt. 1 qr. 15 lb.? *Anſ.* 113 *par.* 12 *lb.* 4 *oz.*

The allowances uſually made in this weight are TARE, TRET, *and* CLOFF.

TARE is an allowance made to the buyer, for the weight of the box, barrel, bag, &c. which contains the goods bought, and is either at ſo much *per* box, bag, barrel, &c.—At ſo much *per cent.* or—At ſo much in the groſs weight.

Tret is an allowance of 4 lb. in every 104 lb. for waſte, duſt, &c. made by the merchant to the buyer.

Cloff is the allowance of 2 lb. to the citizens of London, on every draught above 3 cwt. on ſome ſort of goods.

Groſs weight is the whole weight of any ſort of goods, and that which contains it.

Suttle is when part of the allowance is deducted from the groſs.

Neat is the pure weight, when all allowances are deducted.

RULE 1. When the tare is ſo much *per* bag, barrel, &c. multiply the number of bags, barrels, &c. by the tare, and ſubtract the product from the groſs; the remainder is neat.

Note, *To reduce pounds into gallons multiply by* 2, *divide by* 15.

57. In 7 frails of raiſins, each weighing 5 cwt. 2 qrs 5 lb. groſs, tare at 23 lb. per frail—how much neat weight?

Anſ. 37 *cwt.* 1 *qr.* 14 *lb. or thus:*

```
    23                5 : 2 :  5             5 : 2 :  5
     7                         7                     23
    ———4(            ——————————             ——————————
28)161 (5—          38 : 3 :  7=groſs.       5 : 1 : 10
   140  1 1          1 : 1 : 21=tare.                 7
   ———               ——————————             ——————————
    21              37 : 1 : 14 neat        37 : 1 : 14
    ==              ============            ============
```

58. In 241 barrels of figs, each 3 qrs. 19 lb. groſs; tare 10 lb. *per* barrel—how many pounds neat? *Anſ.* 22413.

59. What is the neat weight of 25 hogſheads of tobacco, weighing groſs 163 cwt. 2 qrs. 15 lb. tare 100lb. *per* hogſhead? *Anſ.* 141 *cwt.* 1 *qr.* 7*lb.*

60. In 16 bags of pepper, each 85 lb. 4 oz. groſs; tare *per* bag, 3 lb. 5 oz.—how many pounds neat? *Anſ.* 1311.

RULE 2. When the tare is at ſo much in the whole groſs weight, ſubtract the given tare from the groſs, the remainder is neat.

61. What is the neat weight of 5 hogſheads of tobacco, weighing groſs 75 cwt. 1 qr. 14lb.—tare in the whole 752 lb.? *Anſ.* 68 *cwt.* 2 *qrs.* 18 *lb.*

62. In 75 barrels of figs, each 2 qrs 27 lb. groſs; tare in the whole 597lb.—how much neat weight? *Anſ.* 50 *cwt.* 1 *qr.*

RULE 3. When the tare is at ſo much *per cwt.* divide the groſs weight by the aliquot parts of an cwt. which ſubtract from the groſs, the remainder is neat.

Note. 7lb. is $\frac{1}{16}$; 8lb. is $\frac{1}{14}$; 14lb. is $\frac{1}{8}$; 16lb. is $\frac{1}{7}$.

63. What is the neat weight of 18 butts of currans, each 8 cwt. 2 qrs. 5lb.; tare at 14lb. *per* cwt.

$$\begin{array}{rr} & 8:2:5 \\ & 9\times2=18 \\ \hline & 76:3:17 \\ & 2 \\ \hline 14=\frac{1}{8}) & 153:3:6 \\ & 19:0:25\frac{1}{4} \\ \hline & 134:2:8\frac{3}{4} \\ \hline\hline \end{array}$$

64. In 25 barrels of figs, each 2 cwt. 1 qr. groſs; tare *per cent.* 16lb.—how much neat weight? *Anſ.* 48 *cwt.* 24*lb.*

65. What is the neat weight of 9 hogſheads of nutmegs, each weighing groſs 8 cwt. 3 qrs. 14lb.; tare 16lb. *per cent.*? *Anſ.* 68 *cwt.* 1 *qr.* 24 *lb.*

66. What is the neat weight of 12 caſks of argol, groſs 84 cwt. 2 qrs. 14 lb.; tare *per cent.* 14 lb.?

Anſ. 74 *cwt.* 5$\frac{1}{4}$ lb.

RULE 4. When tret is allowed with tare, divide the pounds ſuttle by 26, the quotient is the tret, which ſubtract from the ſuttle; the remainder is neat.

67. In one butt of currans, weighing 12 cwt. 2 qrs. 24 lb. groſs; tare 14 lb. *per cent.* tret 4 lb. *per* 104 lb.——how many pounds neat?

12 : 2 : 24

4

50

28

14 = $\frac{1}{8}$) 1424 *groſs.*

178 *tare.*

26) 1246 *ſuttle.*

47 *tret*

1199 *neat.*

68. In 7 cwt. 3 qrs. 27 lb. groſs; tare 36 lb. tret 4 lb. *per* 104 lb.—how many pounds neat? *Anſ.* 826 *lb.*

69. In 152 cwt. 1 qr. 3 lb. groſs; tare 10 lb *per cent.* tret 4 lb. *per* 104 lb.—how much neat weight?

Anſ. 133 *cwt.* 1 *qr.* 11 *lb.*

70. In 15 cheſts of ſugar, weighing 117 cwt 21 lb. groſs; tare 173 lb. tret 4 lb. *per* 104 lb.—how many cwt. neat?

Anſ. 111 *cwt.* 22 *lb.*

RULE 5. When cloff is allowed, multiply the cwt. ſuttle by 2, divide the product by 3; the quotient will be the pounds cloff, which ſubtract from the ſuttle; the remainder will be neat.

71. What is the neat weight of 3 hogſheads of tobacco, weighing 15 cwt. 3 qrs. 20 lb. groſs; tare 7 lb. *per cent.* tret 4 lb. *per* 104 lb. cloff 2 lb. for 3 cwt.?

Anſ. 14 *cwt.* 1 *qr.* 3 *lb.*

7 = $\frac{1}{16}$) 15 : 3 : 20 *groſs.*

3 : 27½ *tare.*

$\frac{1}{26}$) 14 : 3 : 20½ *ſuttle.*

2 : 8 *tret.*

14 : 1 : 12½ *ſuttle.*

9½ *cloff.*

14 : 1 : 3 *neat.*

72. In 7 hogſheads of tobacco, each weighing groſs 5 cwt. 2 qrs. 7lb.; tare 8 lb. *per cent.* tret 4 lb. *per* 104 lb. cloff. 2 lb. *per* 3 cwt.—how much neat weight?
Anſ. 34 *cwt.* 2 *qrs.* 8 *lb.*

APOTHECARIES' WEIGHT.

73. In 27 ℔. 7 ℥. 2 ʒ. 1 ℈. 2 gr.—how many grains?
Anſ. 159022.

74. How many ℔. ℥. ʒ. ℈. gr. are there in 159022 grains? *Anſ.* 27℔. 7℥. 2ʒ. 1℈. 2gr.

CLOTH MEASURE.

75. In 27 yards—how many nails? *Anſ.* 432.

76. In 75 Engliſh ells—how many yards?
Anſ. 93 *yards*, 3 *qrs.*

77. In 93¾ yards—how many Engliſh ells? *Anſ.* 75.

78. In 24 pieces, each containing 32 Flemiſh ells—how many ells Engliſh? *Anſ.* 460 *ells*, 4 *qrs.*

79. In 17 pieces of cloth, each 27 Flemiſh ells—how many yards? *Anſ.* 344 *yds.* 1 *qr.*

80. Bought 27 pieces of Engliſh ſtuffs, each 27 ells—how many yards? *Anſ.* 911 *yds.* 1 *qr.*

81. In 911¼ yards—how many Engliſh ells? *Anſ.* 729.

82. In 12 bales of cloth, each 25 pieces, each 15 Engliſh ells—how many yards? *Anſ.* 5625.

LONG MEASURE.

83. In 57 miles—how many furlongs and poles?
Anſ. 456 *furlongs*; 18240 *poles.*

84. In 7 miles—how many feet, inches, and barley-corns?
Anſ. 36960 *feet*; 443520 *inches*; 1330560 *barley-corns.*

85. In 18240 poles—how many furlongs and miles?
Anſ. 456 *furlongs*; 57 *miles.*

86. In 72 leagues—how many yards? *Anſ.* 380160.

87. In 380160 yards—how many miles and leagues?
Anſ. 216 *miles*; 72 *leagues.*

88. If from London to York be accounted 50 leagues, I demand how many miles, yards, feet, inches, and barley-corns? *Anſ.* 150 *miles*; 264000 *yards*; 792000 *feet*; 9504000 *inches*; 28512000 *barley-corns.*

89. How many barley-corns will reach round the world, which is 360 degrees, each degree 69 miles and a half?
Anſ 4755801600 *barley-corns.*

LAND MEASURE.

90. In 27 acres—how many roods and perches?
Anſ. 108 *roods*; 4320 *perches.*

91. In 4320 perches—how many acres? *Anſ.* 27.

92. A perſon having a piece of ground, containing 37 acres, 1 pole, has a mind to diſpoſe of 15 acres to A; I deſire to know how many perches he will have left? *Anſ.* 3521.

93. There are 4 fields to be divided into ſhares of 75 perches each; the firſt field containing 5 acres; the ſecond 4 acres 2 poles; the third 7 acres, 3 roods; and the fourth 2 acres, 1 rood;—I deſire to know how many ſhares are contained therein? *Anſ.* 40 *ſhares,* 42 *perches.*

WINE MEASURE.

94. Bought 5 tuns of Port wine—how many gallons and pints? *Anſ.* 1260 *gallons*; 10080 *pints.*

95. In 10080 pints—how many tuns? *Anſ.* 5

96. In 5896 gallons of Canary—how many pipes and hogſheads, and of each a like number?
Anſ. 31 *of each,* 37 *gallons over.*

97. A gentlemen ordered his butler to bottle off $\frac{2}{3}$ of a pipe of French wine into quarts, and the reſt into pints.—I deſire to know how many dozen of each he had?
Anſ. 28 *dozen of each.*

ALE AND BEER MEASURE.

98. In 46 barrels of beer—how many pints? *Anſ.* 13248.

99. In ten barrels of ale—how many gallons and quarts?
Anſ. 320 *gals.* 1280 *qts.*

100. In 72 hogſheads of beer—how many barrels?
Anſ. 108 *barrels.*

101. In 108 barrels of beer—how many hogſheads?
Anſ. 72.

DRY MEASURE.

102. In 120 quarters of wheat—how many buſhels, pecks, gallons, and quarts?
Anſ. 960 *buſhels,* 3840 *pecks,* 7680 *gallons,* 30720 *qts.*

103. In 30720 quarts of corn—how many quarters? *Anſ.* 120.

104. In 20 chaldrons of coals—how many pecks? *Anſ.* 2880.

105. In 273 laſts of corn—how many pecks? *Anſ.* 87360.

TIME.

106. In 72015 hours—how many weeks? *Anſ.* 428 *weeks,* 4 *days,* 15 *hours.*

107. How many days is it ſince the birth of our Saviour to Chriſtmas, 1794? *Anſ.* 654893 *days,* 6 *hours.*

108. Stow writes, London was built 1108 years before our Saviour's birth—how many hours is it ſince to Chriſtmas, 1794? *Anſ.* 25412772 *hours.*

109 From November 17, 1738, to September 12, 1739, how many days? *Anſ.* 299 *days.*

110. From July 18, 1723, to December 27, in the ſame year—how many days? *Anſ.* 162 *days.*

111. From July 18, 1723, to April 18, 1750—how many years and days? *Anſ.* 26 *years,* 9770 *days, reckoning* 365 *days,* 6 *hours to a year.*

The SINGLE RULE *of* THREE DIRECT

TEACHETH, by three numbers given, to find out a fourth, in ſuch proportion to the third, as the ſecond is to the firſt.

RULE. Firſt ſtate the queſtion, that is, place the numbers in ſuch order, that the firſt and third be of one kind, and the ſecond the ſame as the number required; then bring the firſt and third numbers into one name, and the ſecond into the loweſt term mentioned. Multiply the ſecond and third numbers together, and divide the product by the firſt, the quotient will be the anſwer to the queſtion, in the ſame denomination you left the ſecond number in.

EXAMPLES.

1. If 1 lb. of ſugar coſt $4\frac{1}{4}d.$—what coſt 54lb.?

```
1  :  4½  ::  54
      4       18
      -     ------  Anſ. £1 : 0 : 3.
      18    4)972
           12)243
          -------
           20s. 3d.
           =====
```

2. If a gallon of ale coſt 3*d.*—what is that *per* barrel? *Anſ.* 9*s.*

3. If a pair of ſhoes coſt 4*s.* 6*d.*—what will 12 dozen come to? *Anſ.* £32 : 8*s.*

4. If 12 dozen pair ſtockings coſt 32*l.* 8*s.*—what is that *per* pair? *Anſ.* 4*s.* 6*d.*

5. If 1 yard of cloth coſt 15*s.* 6d.—what will 32 yards coſt at the ſame rate? *Anſ.* £24 : 16*s.*

6. If 32 yards of cloth coſt 24*l.* 16*s.*—what is the value of 1 yard? *Anſ.* 15*s.* 6*d.*

7. If 1 lb. of ſugar coſt 10½*d.*—what is the worth of 1 cwt.? *Anſ.* £4 : 18*s.*

8. If I gave 4*l.* 18*s.* for a cwt. of ſugar—at what rate did I buy it at *per* lb.? *Anſ.* 10½*d.*

9. If I buy 20 pieces of cloth, each 20 ells, for 12*s.* 6*d.* *per* ell—what is the value of the whole? *Anſ.* £250.

10. Bought 20 pieces of Holland, each 20 ells, for 250*l.*—what is that *per* ell? *Anſ.* 12*s.* 6d.

11. What will 25 cwt. 3 qrs. 14 lb. of tobacco come to at 15½*d.* *per* lb.; *Anſ.* 187 : 3 : 3.

12. I gave 187*l.* 3*s.* 3*d.* for 25 cwt. 3 qrs. 14 lb. of tobacco—what rate did I buy it at *per* lb. *Anſ.* 1*s.* 3½*d.*

13. Bought 27¼ yards of muſlin, at 6*s.* 9½*d.* *per* yard—what does it amount to? *Anſ.* £9 : 5 : 0¾. 2 *rem.*

14. Bought 17 cwt. 1 qr. 14 lb. of iron, at 3½*d.* *per* lb—what does it come to? *Anſ.* £26 : 7 : 0½.

15. If coffee is ſold for 5½*d.* *per* ounce—what muſt be given for 2 cwt.? *Anſ.* £82 : 2 : 8.

16. How many yards of cloth may be bought for 21*l.* 11*s.* 1½*d.* when 3½ yards coſt 2*l.* 14*s.* 3*d.*? *Anſ.* 27 *yds.* 3 *qrs.* 1 *nail*, 42 *rem.*

17. If 3½ lb. of Cheſhire cheeſe coſt 1*s.* 1*d.*—what coſt 1 cwt.? *Anſ.* £1 : 14 : 8.

18. If 1 cwt. of Cheſhire cheeſe coſt 1*l.* 14*s.* 8*d.*—what muſt I give for 3½ lb? *Anſ.* 1*s.* 1*d.*

19. Bought 1 cwt. 24 lb. 8 oz. of old lead at 9*s.* *per* cwt.—what does it come to? *Anſ.* 10*s.* 11½*d.* 112 *rem.*

20. If 1 cwt. 24 lb. 8 oz. of lead be worth 10*s.* 11½*d.* $\frac{112}{224}$—what is that *per* 1 cwt.? *Anſ.* 9*s.*

21. If a gentleman's income is 500*l.* a year, and he ſpends 19*s.* 4*d.* *per* day—how much does he lay by at the year's end? *Anſ.* £147 : 3 : 4.

22. If I buy 14 yards of cloth for 10 guineas—how many Flemiſh ells can I buy for 283*l.* 17*s.* 6*d.* at the ſame rate? *Anſ.* 504 *Fl. ells, 2 qrs.*

23. If 283*l.* 17*s.* 6*d.* will buy 504 Flemiſh ells, 2 quarters —what quantity of yards can I have for 10*l.* 10*s.*? *Anſ.* 14 *yds.*

24. If 504 Flemiſh ells, 2 qrs. coſt 283*l.* 17*s.* 6*d.*—at what rate muſt I give for 14 yards? *Anſ.* £10 : 10*s.*

25. If I give 1*l.* 1*s.* 8*d.* for 3 lb. of coffee—what muſt be given for 29 lb. 4 oz.? *Anſ.* £10 : 11 : 3.

26. Bought 29 lb. 4 oz. of coffee, for 10*l.* 11*s.* 3*d.*—what what is the value of 3 lb.? *Anſ.* £1 : 1 : 8.

27. If $1\frac{1}{2}$ oz. of coffee coſt $6\frac{1}{4}$*d.*—what will $3\frac{1}{4}$ oz. coſt at the ſame rate? *Anſ.* 1*s.* $1\frac{1}{2}$*d.* 1 *rem.*

28. If 1 Engliſh ell, 2 qrs. coſt 4*s.* 7*d.*—what will $39\frac{1}{2}$ yards coſt at the ſame rate? *Anſ.* £5 : 3 : $5\frac{1}{4}$. 5 *rem.*

29. If 1 ounce of gold is worth 5*l.* 4*s.* 2*d.*—what is the worth of 1 grain? *Anſ.* $2\frac{1}{2}$*d.* 20 *rem.*

30. If 14 yards of broad cloth coſt 9*l.* 12*s.*—what is the purchaſe of 75 yards? *Anſ.* £51 : 8 : $6\frac{3}{4}$. 6 *rem.*

31. If 27 yards of Holland coſt 5*l.* 12*s.* 6*d.*—how many ells Engliſh can I buy for 100*l.*? *Anſ.* 384.

32. If 1 cwt. coſt 12*l.* 12*s.* 6*d.*—what muſt I give for 14 cwt. 1 qr. 19 lb.? *Anſ.* £182 : 0 : $11\frac{1}{2}$. 8 *rem.*

33. Bought 7 yards of cloth for 17*s.* 8*d.*—what muſt be given for 5 pieces, each containing $27\frac{1}{2}$ yards? *Anſ.* £17 : 7 : $0\frac{1}{4}$. 2 *rem.*

34. If 7 oz. 11 dwt. of gold be worth 35*l.*—what is the value of 14 lb. 9 oz. 12 dwt. 16 gr. at the ſame rate? *Anſ.* 823 : 9 : $3\frac{3}{4}$. 552 *rem.*

35. A draper bought 420 yards of broad cloth, at the rate of 14*s.* $10\frac{3}{4}$*d.* *per* ell Engliſh—how much did he pay for the whole? *Anſ.* £250 : 5*s.*

36. A gentleman bought a wedge of gold which weighed 14 lb. 3 oz. 8 dwt. for the ſum of 514*l.* 4*s.*—at what rate did he pay for it *per* ounce? *Anſ.* £3.

37. A grocer bought 4 hogſheads of ſugar, each weighing neat 6 cwt. 2 qrs. 14 lb. which coſt him 2*l.* 8*s.* 6*d.* *per* cwt. —what is the value of the 4 hogſheads? *Anſ.* £64 : 5 : 3.

38. A draper bought 8 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of 4*l.* 16*s.* for 6 yards—I deſire to know what the 8 packs ſtood him in? *Anſ.* £6656.

39. If 24 lb. of raiſins coſt 6*s.* 6*d.*—what will 18 frails coſt, each weighing neat 3 qrs. 18 lb.? *Anſ.* £24 : 17 : 3.

40. If 1 ounce of ſilver be worth 5*s.*—what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwt.? *Anſ.* £313 : 5*s.*

41. What is the price of a pack of wool weighing 2 cwt. 1 qr. 19 lb. at 8*s.* 6*d.* *per* ſtone? *Anſ.* £8 : 4 : 6¼. 10 *rem.*

42. Bought 59 cwt. 2 qrs. 24 lb. of tobacco, at 2*l.* 17*s.* 4*d.* *per* cwt.—what does it come to? *Anſ.* £171 : 3 : 7¼. 80 *rem.*

43. What is the half-year's rent of 547 acres of land, at 15*s.* 6*d.* *per* acre *per annum?* *Anſ.* £211 : 19 : 3.

44. Bought 171 tons of lead, at 14*l.* *per* ton, paid carriage, and other incident charges 4*l.* 10*s.*—I require the value of the lead, and what it ſtands me in *per* lb.?

Anſ. £2398 : 10*s.*; *value* 1½*d.* *per lb.*; 432 *rem.*

45. If a pair of ſtockings coſt 10 groats—how many dozen may I buy for 43*l.* 5*s.*? *Anſ.* 21 *doz.* 7½ *pair.*

46. Bought 27 dozen 5 lb. of candles, after the rate of 1*s.* 5*d.* *per* 3 lb.—what did they coſt me?

Anſ. £7 : 15 : 4½. 1 *rem.*

47. If an ounce of fine gold is ſold for 3*l.* 10*s.*—what come 7 ingots to, each weighing 3 lb. 7 oz. 14 dwt. 21 gr. at the ſame price? *Anſ.* £1071 : 14 : 5¼.

48. If my horſe ſtands me in 9½*d.* *per* day keeping—what will be the charge of 11 horſes for the year?

Anſ. £158 : 18 : 6½.

49. A factor bought 86 pieces of ſtuff, which coſt him 517*l.* 19*s.* 4*d.* at 4*s.* 10*d.* *per* yard—I demand how many yards there were, and how many ells Engliſh in a piece?

Anſ. 2143¼ *yards,* 14 *rem.*
and 19 *ells,* 4 *quarters,* 2 *nails in a piece.* 64 *rem.*

50. A gentleman hath an annuity of 896*l.* 17*s.* *per annum*—I deſire to know how much he may ſpend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 10 moidores? *Anſ.* £1 : 14 : 8. 44 *rem.*

The RULE *of* THREE INVERSE.

INVERSE PROPORTION is, when more requires leſs, and ſs requires more. *More requires leſs,* is when the third term is greater than the firſt, and requires the fourth term to be leſs than the ſecond. And *leſs requires more,* is when the third term is leſs than the firſt, and requires the fourth term to be greater than the ſecond.

Rule. Multiply the firſt and ſecond terms together, and divide the product by the third; the quotient will bear ſuch proportion to the ſecond as the firſt does to third.

Examples.

1. If 8 men can do a piece of work in 12 days—in how many days can 16 men perform the ſame? *Anſ.* 6 *days.*

8 : 12 :: 16 : 6
8
———
16)96(6 *days*
96
═══

2. If 54 men can build a houſe in 90 days—how many men can do the ſame in 50 days? *Anſ.* $97\frac{1}{5}$ *men.*

3. If when a peck of wheat is ſold for 2*s.* the penny-loaf weighs 8 oz.—how much muſt it weigh when the peck is worth but 1*s.* 6d.? *Anſ.* 1 *oz.* $10\frac{2}{3}$ *dr.*

4. How many pieces of money of 20*s.* value are equal to 240 pieces of 12*s.* each? *Anſ.* 144.

5. How many yards of three-quarters wide are equal in meaſure to 30 yards of five quarters wide? *Anſ.* 50.

6. If I lend my friend 200*l.* for 12 months——how long ought he to lend 150*l.* to requite my kindneſs?
Anſ. 16 *months.*

7. If for 24*s.* I have 1200 lb. carried 36 miles—how many pounds can I have carried 24 miles for the ſame money? *Anſ.* 1800 *lb.*

8. If 100 workmen finiſh a piece of work in 12 days—how many are ſufficient to finiſh it in 3 days? *Anſ.* 400.

9. An army beſieging a town, in which were 1000 ſoldiers, with proviſions for three months—how many ſoldiers departed, when the proviſions laſted them 6 months?
Anſ. 500.

10. If 20*l.* worth of wine is ſufficient to ſerve an ordinary of 100 men, when the tun is ſold for 30*l.*—how many will 20*l.* worth ſuffice, when the tun is ſold for but 24*l.*?
Anſ. 125 *men.*

11. A courier makes a journey in 24 days, when the day

is but 12 hours long—how many days will he be going the ſame journey, when the days are 16 hours long? *Anſ.* 18 *days.*

12. How much pluſh is ſufficient for a cloak, which has in it 4 yards of 7 quarters wide of ſtuff for the lining, the pluſh being but 3 quarters wide? *Anſ.* 9$\frac{1}{3}$ *yards.*

13. If 14 pioneers make a trench in 18 days—how many days will 34 men take to do the ſame?

Anſ. 7 *days,* 4 *hours,* 56 *minutes,* 16 *rem.*

14. Borrowed of my friend 64*l.* for eight months, and he hath occaſion another time to borrow of me for 12 months—how much muſt I lend him to requite his former kindneſs to me? *Anſ.* £42 : 13 : 4.

25. A regiment of ſoldiers, conſiſting of 1000 men, are to have new coats, each coat to contain 2$\frac{1}{2}$ yards of cloth, 5 quarters wide, and to be lined with ſhalloon of 3 quarters wide—I demand how many yards of ſhalloon will line them?

Anſ 4166 *yards,* 2 *quarters,* 2 *nails,* 2 *rem.*

The DOUBLE RULE *of* THREE

IS ſo called, becauſe it compoſed of 5 numbers given to find a ſixth, which if the proportion is direct, muſt bear ſuch proportion to the 4th and 5th, as the 3 bears to the 1ſt and 2. But if Inverſe, the 6th number muſt bear ſuch proportion to the 4th and 5th, as the 1ſt bears to the 2d and 3d. The three firſt terms are a *ſuppoſition*; the two laſt, a *demand*.

Rule 1. Let the principal cauſe of loſs or gain, intereſt or decreaſe, action or paſſion, be put in the firſt place.

2. Let that which betokeneth time, diſtance of place and the like, be in the ſecond place, and the remaining on, in the third.

3. Place the other terms under their like, in the ſuppoſition.

4. If the blank falls under the third term, multiply the firſt and ſecond terms for a diviſor, and the other three for a dividend. But,

5. If the blank falls under the firſt or ſecond term, multiply the 3d and 4th terms for a diviſor, and the other three for the dividend and the quotient will be the anſwer.

Proof. By two Single Rules of Three.

Examples.

EXAMPLES.

1. If 14 horſes eat 56 buſhels of oats in 16 days—how many buſhels will be ſufficient for 20 horſes for 24 days?

By two Single Rules.	*or in one ſtating worked thus:*
hor. bu. hor. bu.	*hor. da. bu.*
1. *As* 14 : 56 :: 20 : 80	14 : 16 : 56
da. bu. hor. bu.	
2. *As* 16 : 80 :: 24 : 120	20 : 24 : –

$$\frac{56\times20\times24}{4\times16}=120$$

2. If 8 men in 14 days can mow 112 acres of graſs—how many men muſt there be to mow 2000 acres in 10 days?

ac. da. ac. da.	*m. da. ac.*
1. *As* 112 : 14 :: 2000 : 250	8 : 14 : 112
da. m. da. m.	
2. *A* 250 : 8 :: 10 : 200	– : 10 : 2000

$$\frac{8\times14\times2000}{112\times10}=200$$

3 If 100*l* in 12 months gain 6*l*. intereſt—how much will 75*l*. gain in 9 months? *Anſ* £3 : 7 : 6.

4 If a carrier receives 2*l*. 2*s*. for the carriage of 3 cwt. 150 miles—how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. for 50 miles? *Anſ*. £1 : 16 : 9.

5. If a regiment of ſoldiers, conſiſting of 136 men conſume 351 quarters of wheat in 108 days—how many quarters of wheat will 11232 ſoldiers conſume in 56 days? *Anſ* 15031.

6. If 40 acres of graſs be mowed by 8 men in 7 days—how many acres can be mowed by 24 men in 28 days? *Anſ*. 408.

7. If 40*s*. will pay 8 men for 5 days' work—how much will pay 32 men for 24 days' work? *Anſ*. £38 : 8*s*.

8. If 100*l*. in 12 months gain 6*l*. intereſt—what principal will gain 3*l*. 7*s*. 6*d*. in 9 months? *Anſ*. £75.

9 If a regiment conſiſting of 939 ſoldiers, conſume 351 quarters of wheat in 168 days—how many ſoldiers will conſume 1404 quarters in 56 days? *Anſ*. 11268.

10. If in a family conſiſting of 7 perſons, there are drank out two kilderkins of beer in 12 days—how many kilderkins will there be drank out by another family of 14 perſons in 8 days? *Anſ*. 2 *kil*. 12 *gal*.

11. If the carriage of 60 cwt. 20 miles coſt 14*l*. 10*s*.—what weight can I have carried 30 miles, for 5*l*. 8*s*. 9*d*. at the ſame rate of carriage? *Anſ*. 15 *cwt*.

12. If 2 horſes eat 8 buſhels of oats in 16 days—how many horſes will eat up 3000 quarters in 24 days? *Anſ* 4000.

13. If 100*l*. in 12 months gain 7*l*. intereſt—what is the intereſt of 571*l*. for 6 years? *Anſ*. £239 : 16 : $3\frac{3}{4}$.

14. If I pay 10*s.* for the carriage of 2 tons, 6 miles—what muſt I pay for the carriage of 12 tons, 17 cwt. for 17 miles? *Anſ.* £9 : 2 : 0½.

PRACTICE

IS ſo called, from the general uſe thereof by all perſons concerned in trade and buſineſs.

All queſtions in this rule are performed by taking aliquot or even parts, by which means many tedious reductions are avoided: the table of which is as follows:

Of a Pound.				*Of a Shilling.*			*Of a Ton.*			*Of an Hundred.*				
s.	*d.*			*d.*			*cwt.*			*qrs.*		*lb.*		
10	0	is	½	6	is	½	10	is	½	2	or	56	is	½
6	8	—	⅓	4	—	⅓	5	—	¼	1	or	28	—	¼
5	0	—	¼	3	—	¼	4	—	⅕			14	—	⅛
4	0	—	⅕	2	—	⅙	2½	—	⅛	*Of a Quarter.*				
3	4	—	⅙	1½	—	⅛	2	—	⅒	14		℔	is	½
2	6	—	⅛	1	—	$\frac{1}{12}$				7		—	—	¼
2	0	—	⅒							4		—	—	⅐
1	8	—	$\frac{1}{12}$							3½		—	—	⅛

RULE I. When the price is leſs than a penny, divide by the aliquot parts that are in a penny; then by 12 and 20, it will be the anſwer.

¼ is ¼ 5704*lb.* at ¼	7695 at ½	6547 at ¾
12)1426	*facit* £16 0 7½	*facit* £20 9 2¼
2|0)11|8 10	5740 at ½	4573 at ¾
£5 18 10	*facit* £11 19 2	*facit* £14 5 9¾

RULE II. When the price is leſs than a ſhilling, take the aliquot part or parts that are in a ſhilling, add them together, and divide by 20, as before.

1 is $\frac{1}{12}$ 7547 at 1*d.*	54325 at 1½*d.*	3250 at 2¾*d.*
2|0)62|8 11	*facit* £339 10 7½*d.*	*facit* £37 4 9½
£31 8 11	6254 at 1¾	2715 at 3*d.*
	facit £45 12 0½	*facit* £33 18 9
1 is $\frac{1}{12}$ 3751 at 1¼*d.*	2351 at 2*d.*	7062 at 3¼*d.*
¼ is ¼) 312 7	*facit* £19 11 10	*facit* £95 12 9½
78 1¾	7210 at 2¼*d.*	2147 at 3½*d.*
2|0)39|0 8¾	*facit* £67 11 10½	*facit* £31 6 2½
£19 10 8¾	2710 at 2½*d.*	7000 at 3¾*d.*
	facit £28 4 7	*facit* £109 7 6

3257 at 4*d* *facit* £54 5 8	2708 at 6¾*d*. *facit* £76 3 3	7924 at 9½*d*. *facit* £133 13 2
2056 at 4¼*d*. *facit* £36 8 2	3271 at 7*d*. *facit* £95 8 1	2150 at 9¾*d*. *facit* £87 6 10½
3752 at 4½*d*. *facit* £70 7 0	3254 at 7¼*d*. *facit* £98 5 11½	6325 at 10*d*. *facit* £263 10 10
2107 at 4¾*d*. *facit* £41 14 0¼	2701 at 7½*d* *facit* £84 8 1½	5724 at 10¼. *facit* £244 9 3
3210 at 5*d*. *facit* £66 17 6	3714 at 7¾*d*. *facit* £119 18 7½	6327 at 10¼*d*. *facit* £270 4 3¾
2715 at 5¼*d*. *facit* £59 7 9¾	2710 at 8*d*. *facit* £90 6 8	3254 at 10½*d*. *facit* 142 7 3
3120 at 5½*d*. *facit* £71 10 0	3514 at 8¼ *facit* £120 15 10½	7291 at 10¾*d*. *facit* £326 11 6¼
7521 at 5¾*d*. *facit* £180 3 9¾	2759 at 8½ *facit* £97 14 3½	3256 at 11*d*. *facit* £149 4 8
3271 at 6*d*. *faeit* £81 15 6	9872 at 8¾*d*. *facit* £359 18 4	7254 at 11¼*d*. *facit* £340 0 7½
7914 at 6¼*d*. *facit* £206 1 10½	5272 at 9*d*. *facit* £197 14 0	3754 at 11½*d*. *facit* £179 17 7
3250 at 6½ *facit* £88 0 5	6325 at 9¼*d*. *facit* £243 15 6¼	7972 at 11¾*d*. *facit* £390 5 11

RULE III. When the price is more than one ſhilling, and leſs than two, take the part or parts, with ſo much of the given price as is more than a ſhilling, which add to the given quantity, and divide by 20, it will give the anſwer.

¼ 1/48 2106 at 12¼. 43 10½ 2|0)214|9 10½ £107 9 10½	½ 1/24 3715 at 12½*d*. 154 9½ 2|0)386|9 9½ £193 9 9½	2712 at 12¾*d*. *facit* £144 1 6 2107 at 1*s*. 1*d*. *facit* £114 2 7

3215 at 1*s*. 1¼*d*.
facit £177 9 10¾

2790 at 1*s*. 1½*d*.
facit £156 18 9

7904 at 1*s*. 1½*d*
facit £452 16 8

3750 at 1*s*. 2*d*.
facit £218 15 0

3291 at 1*s*. 2¼*d*
facit £195 8 0¾

9254 at 1*s*. 2½
facit £559 1 11

7250 at 1*s*. 2¾*d*.
facit £445 11 5½

7591 at 1*s*. 3*d*.
facit £474 8 9

6325 at 1*s*. 3¼*d*.
facit £401 18 0¼

5271 at 1*s*. 3½*d*.
facit £340 8 4½

3254 at 1*s*. 3¾*d*.
facit £213 10 10½

2915 at 1*s*. 4*d*.
facit £194 6 8

3270 at 1*s*. 4¼*d*
facit £221 8 1½

7059 at 1*s*. 4½*d*.
facit £485 6 1½

2750 at 1*s*. 4¾*d*.
facit £191 18 6½

3725 at 1*s* 5*d*.
facit £263 17 1

7250 at 1*s*. 5¼*d*
facit £521 1 10½

2597 at 1*s*. 5½*d*.
facit £189 7 3½

7210 at 1*s*. 5¾*d*.
facit £533 4 9½

7524 at 1*s*. 6*d*.
facit £564 6 0

7103 at 1*s*. 6¼*d*.
facit £540 2 5¾

3254 at 1*s*. 6½*d*.
facit £250 16 7

7925 at 1*s*. 6¾*d*.
facit £619 2 9¾

9271 at 1*s*. 7*d*.
facit £733 19 1

7210 at 1*s*. 7¼*d*.
facit £578 6 0½

2310 at 1*s*. 7½.
facit £187 13 9

2504 at 1*s*. 7¾*d*.
facit £206 1 2

1752 at 1*s*. 8*d*.
facit £596 0 0

2905 at 1*s*. 8¼*d*.
facit £245 2 2¼

7104 at 1*s*. 8½*d*.
facit £606 16 0

1004 at 1*s*. 8¾*d*.
facit £86 16 1

2104 at 1*s*. 9*d*.
facit £184 2 0

2571 at 1*s*. 9¼*d*.
facit £227 12 9¾

2104 at 1*s*. 9½*d*.
facit £188 9 8

7506 at 1*s*. 9¾*d*.
facit £630 4 7½

1071 at 1*s*. 10*d*.
facit £98 3 6

5200 at 1*s*. 10¼*d*.
facit £482 1 8

2117 at 1*s*. 10½*d*.
facit £198 9 4½

1007 at 1*s*. 10¾*d*.
facit £95 9 1¼

5000 at 1*s*. 11*d*.
facit £479 3 4

2105 at 1*s*. 11¼*d*.
facit £203 18 5¼

1006 at 1*s*. 11½*d*.
facit £98 10 1

2705 at 1*s*. 11¾*d*.
facit £267 13 7¾

5000 at 1*s*. 11½*d*.
facit £489 11 8

4000 at 1*s*. 11¾*d*.
facit £395 16 8

Rule IV. When the price conſiſts of any even number of ſhillings under 20, multiply the given quantity by half the price, doubling the firſt figure of the product for ſhillings, and the reſt of the product will be pounds.

2750 at 2*s.*
facit £275 0 0

3254 at 4*s.*
facit £650 16 0

2710 at 6*s.*
facit £813 0 0

1572 at 8*s.*
facit £628 16 0

2102 at 10*s.*
facit £1051 0 0

2101 at 12*s.*
facit £1260 12 0

5271 at 14*s.*
facit £3689 14 0

3123 at 16*s.*
facit £2498 8 0

1075 at 16*s.*
facit £860 0 0

1621 at 18*s.*
facit £1458 18 0

☞ *When the price is* 10*s. take half of the quantity, and if any remain, it is* 10*s.*

Rule V. When the price conſiſts of odd ſhillings, multiply the given quantity by the price, and divide by 20; the product will be the anſwer.

2703 at 1*s.*
facit £135 3 0

3270 at 3*s.*
3
2|0)981|0
£490 10 0

3271 at 5*s.*
facit £817 15 0

2715 at 7*s.*
facit £950 5 0

3214 at 9*s.*
facit £1446 6 0

2710 at 11*s.*
facit £1490 10 0

3179 at 13*s.*
facit £2066 7 0

2150 at 15*s.*
facit £1612 10 0

3142 at 17*s.*
facit £2670 14 0

2150 at 19*s.*
facit £2042 10 0

7157 at 19*s.*
facit £6799 3 0

☞ *When the price is* 5*s. divide the quantity by* 4, *and if any remain it is* 5*s.*

Rule VI. When the price is ſhillings and pence, and they the aliquot part of a pound, divide by the aliquot part, and it will give the anſwer at once; but if they are not an aliquot part, then multiply the quantity by the ſhillings, and take parts of the reſt, add them together and divide by 20.

s. *d.*
6 8 | $\frac{1}{3}$

2710 at 6*s.* 8*d.*
facit £903 6 8

3150 at 3*s.* 4*d.*
facit £525 0 0

2715 at 2*s.* 6*d.*
facit £339 7 6

7150 at 1*s.* 8*d.*
facit £595 16 8

3215 at 1*s.* 4*d.*
facit £214 6 8

7211 at 1*s.* 3*d.*
facit £450 13 9

2 | $\frac{1}{6}$ | 2710 at 3*s.* 2*d.*
3

8130
451 8

2|0 | 858|1 8

£429 1 8

7514 at 4*s.* 7*d.*
facit £1721 19 2

2517 at 5*s.* 3*d.*
facit £660 14 3

2547 at 7*s.* 3$\frac{1}{2}$*d.*
facit £928 11 10$\frac{1}{2}$

3271 at 5*s.* 9$\frac{1}{2}$*d.*
facit £943 16 4$\frac{3}{4}$

2103 at 15*s.* 4$\frac{1}{2}$.
facit £1616 13 7$\frac{1}{2}$

7152 at 17*s.* 6$\frac{3}{4}$.
facit £6280 7*s.*

2510 at 14*s.* 7$\frac{1}{4}$*d.*
facit £1832 16 5$\frac{1}{2}$

3715 at 9*s.* 4$\frac{1}{2}$*d.*
facit £1741 8 1$\frac{1}{2}$

2572 at 13*s.* 7$\frac{1}{2}$*d.*
facit £1752 3 6

7251 at 14*s.* 8$\frac{1}{4}$*d.*
facit £5324 19 0$\frac{3}{4}$

3210 at 15*s.* 7$\frac{3}{4}$*d.*
facit £2511 3 1$\frac{1}{2}$

2710 at 19*s.* 2$\frac{1}{2}$*d.*
facit £2602 14 7

RULE VII. *Firſt.* When the price is pounds and ſhilings multiply the quantity by the pounds, and proceed with the ſhillings if they are even, as in the 4th rule; if odd, take the aliquot parts, add them together, the ſum will be the anſwer.

2dly, When pounds, ſhillings, and pence, and the ſhillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the reſt.

3dly, When the price is pounds, ſhillings, pence, and farthings, and the ſhillings and pence not the aliquot parts of a pound, reduce the pounds and ſhillings, into ſhillings, multiply the quantity by the ſhillings, take parts for the reſt, add them together and divide by 20.

☞ *When the given quantity is no more than three figures, proceed as in* Compound Multiplication.

4s.	$\frac{1}{5}$	7215 at £7 4 0
		7
		50505
		1443
		51948£.
s. d.		
2 6	$\frac{1}{8}$	2104 at £5 3 0
		5
		10520
6*d.*	$\frac{1}{5}$	263
		52 12
		10835*l.* 12*s.*
		2107 at £2 8 0
		facit £5056 16
		7156 at £5 6 0
		facit £37926 16
6*d.*	$\frac{1}{2}$	2710 at £2 3 $7\frac{1}{2}$
		43
		116530
$1\frac{1}{2}$*d.*	$\frac{1}{4}$	1355
		338 9
	2|0	11822|3 9
		£5911 3 9
		3215 at £1 17 0
		facit £5947 15*s.*

2107 at £1 13 0
facit £3476 11*s.*

3215 at £4 6 8
facit £13931 13 4

2154 at £7 1 3
facit £15212 12 6

2701 at £2 3 4
facit £5852 3 4

2715 at £1 17 $2\frac{1}{2}$
facit £5051 0 $7\frac{1}{2}$

2517 at £3 15 $2\frac{1}{4}$
facit £1808 19 $5\frac{1}{4}$

3210 at £1 18 $6\frac{3}{4}$
facit £6189 5 $7\frac{1}{2}$

2157 at £2 7 $4\frac{1}{2}$
facit £5109 7 $10\frac{1}{2}$

142 at £1 15 $2\frac{3}{4}$
facit £250 2 $6\frac{1}{2}$

95 at £15 14 $7\frac{1}{4}$
facit £1494 7 $4\frac{3}{4}$

37 at £1 17 $5\frac{3}{4}$
facit £73 0 $8\frac{3}{4}$

2175 at £2 15 $4\frac{1}{2}$
facit £6022 0 $7\frac{1}{2}$

2150 at £17 16 $1\frac{1}{2}$
facit £38283 8 9

RULE VIII. When the price and quantity given are of ſeveral denominations, multiply the price by the integers, and take parts of the integers for the reſt.

1. At 3*l.* 17*s.* 6*d.* *per* cwt.—what is the value of 25 cwt. 2 qrs. 14lb. of tobacco?

qrs.		
2	½	£3 : 17 : 6
		5
		19 : 7 : 6
		5
lb.		96 : 17 : 6
14	¼	1 : 18 : 9
		9 : 8¼
		99 : 5 : 11¼

5×5=25

2. At 1*l.* 4*s.* 9*d.* *per* cwt.—what comes 17 cwt. 1 qr. 17lb. of cheeſe to? *Anſ.* £21 : 10 : 8.

3. Sold 85 cwt. 1 qr. 10lb. of cheeſe, at 1*l.* 7*s.* 8*d.* *per* cwt.—what does it come to? *Anſ.* £118 : 1 : 0½.

4. Hops at 4*l* 5*s.* 8*d.* *per* cwt.—what muſt be given for 72 cwt. 1 qr. 18lb.? *Anſ.* £310 : 3 : 2.

5. At 1*l.* 1*s.* 4*d.* *per* cwt.—what is the value of 27 cwt. 2 qrs. 15lb of Malaga raiſins? *Anſ.* £20 : 9 : 6¼.

6. Bought 78 cwt. 3 qrs. 12lb. of currans, at 2*l.* 17*s.* 9*d.* *per* cwt.—what did I give for the whole? *Anſ.* £227 : 14*s.*

7. Sold 56 cwt. 1 qr. 17lb. of ſugar, at 2*l.* 15*s.* 9*d.* the cwt.—what does it come to? *Anſ.* £157 : 4 : 4½.

8. Tobacco at 3*l.* 17*s.* 10*d.* the cwt.—what is the worth of 97 cwt. 15lb.? *Anſ.* £378 : 0 : 3.

9. At 4*l.* 14*s.* 6*d.* the cwt.—what is the value of 37 cwt. 2 qrs. 13lb of double refined ſugar? *Anſ.* £177 : 14 : 8½.

10. Bought ſugar at 3*l.* 14*s.* 6*d.* the cwt.—what did I give for 15 cwt. 1 qr. 10lb? *Anſ.* £57 : 2 : 9.

11. At 4*l.* 15*s.* 4*d.* the cwt.—the value of 172 cwt. 3 qrs. 12lb. of tobacco is required? *Anſ.* £823 : 19 : 0¼.

12. Soap at 3*l* 11*s.* 6*d.* the cwt. what is the value of 53 cwt. 17lb.? *Anſ.* £190 : 0 : 4.

INTEREST.

INTEREST *is either* **SIMPLE** *or* **COMPOUND.**

SIMPLE INTEREST

IS the PROFIT allowed in lending or forbearance of any ſum of money for a determined ſpace of time.

The PRINCIPAL is the money lent, for which intereſt is to be received.

The RATE PER CENT is a certain ſum agreed on between the borrower and the lender, to be paid for every £100 for the uſe of the principal 12 months.

The AMOUNT is the principal and intereſt added together.

INTEREST is alſo applied to commiſſion, brokage, purchaſing of ſtocks, and inſurance.

To find the Intereſt of any Sum of Money for a Year.

RULE. Multiply the principal by the rate *per cent.* that product, divided by 100, will give the intereſt required.

For ſeveral Years.

Multiply the intereſt of one year by the number of years given in the queſtion, and the product will be the anſwer.

EXAMPLES.

1. What is the intereſt of 375*l.* for a year, at 5 *per cent. per annum?*

```
     5
  -----
  18|75
     20
  -----
  15|00  Anſ. £13 : 15s.
  =====
```

2. What is the intereſt of 268*l.* for one year, at 4 *per cent. per annum?* *Anſ.* £10 : 14 : $4\frac{3}{4}$.

3. What is the intereſt of 945*l.* 10*s.* for a year, at 4 *per cent. per annum?* *Anſ.* £37 : 16 : $4\frac{3}{4}$.

4. What is the intereſt of 547*l.* 15*s.* at 3 *per cent. per annum*, for three years? *Anſ.* £82 : 3 : 3.

5. What is the intereſt of 254*l.* 17*s.* 6*d.* for five years, at 4 *per cent. per annum?* *Anſ.* £50 : 19 : 6¾.

6. What is the intereſt of 556*l.* 13*s.* 4*d.* at 5 *per cent. per annum*, for 5 years? *Anſ.* £139 : 3 : 4.

COMMISSION

Is an allowance from merchants to their factors or correſpondents, in the buying or ſelling of goods, and is generally at a certain rate *per cent.* according to the cuſtom of the country where the factor reſides.

RULE, Multiply the principal by the rate *per cent.* as before; and for ¼, ½, or ¾, take the part or parts from the principal, which added to the product, and divide by 100, will give the anſwer.

7. What is the commiſſion of 287*l.* 10*s.* at 3½ *per cent.*

$$\begin{array}{r} \tfrac{1}{2}\ \tfrac{1}{2},\ 287 : 10 \\ 3 \\ \hline 862 : 10 = 3 \\ 143 : 15 = \tfrac{1}{2} \\ \hline 10|06 : \ \ 5 = 3\tfrac{1}{2} \\ 20 \\ \hline 1|25 \\ 12 \\ \hline 3|00\ \ \textit{Anſ.}\ £10 : 1 : 3. \end{array}$$

8. What muſt I allow my correſpondent for diſburſing on my account 529*l.* 18*s.* 5*d.* at 2¼ *per cent.*? *Anſ.* £11 : 18 : 5½.

9. My correſpondent writes me word, that he has bought goods to the amount of 754*l.* 16*s.* on my account—what does his commiſſion come to at 2½ *per cent.*?

Anſ. £18 : 17 : 4¾.

10. If I allow my factor 3¾ *per cent.* for commiſſion—what may he demand on the laying out 876*l.* 5*s.* 10*d.*

Anſ. £32 : 17 : 2½.

PURCHASING OF STOCKS.

RULE. Multiply the ſum to be purchaſed by the exceſs above 100; divide the product by 100, the produce of which added to the given ſum, is the purchaſe required.

If under *par* (that is under 100) multiply by the rate *per cent.* that product, divided by 100, gives the purchaſe thereof.

11. What is the purchaſe of 575*l.* 10*s.* bank ſtock, at 131$\frac{3}{4}$ *per cent.*

6 × 5 + 1 = 31

575 : 10

6

3453

5

172|65 : 0 : 0 = 30

$\frac{1}{2}$ $\frac{1}{6}$ 575 : 10 : 0 = 1

$\frac{1}{4}$ $\frac{1}{2}$ 287 : 15 : 0 = $\frac{1}{2}$

143 : 17 : 6 = $\frac{1}{4}$

182|72 : 2 : 6 = 31$\frac{3}{4}$

20

14|42

12

5|10

575 : 10 : 0

182 : 14 : 5

Anſ. £758 : 4 : 5

12. What is the purchaſe of 254*l.* 17*s.* bank annuities, at 97$\frac{1}{4}$ *per cent.*?

12 × 8 + 1 = 97

254 : 17

12

3058 : 4

8

24465 : 12 : 0 = 96

$\frac{1}{4}$ $\frac{1}{4}$ 254 : 17 : 0 = 1

63 : 14 : 3 = $\frac{1}{4}$

247|84 : 3 : 3 = 97$\frac{1}{4}$

20

16|83

12

9|99

4

3|96

Anſ. £247 : 16 : 9$\frac{3}{4}$

13. At 110$\frac{1}{4}$ *per cent.*—what is the purchaſe of 2054*l.* 16*s.* South-Sea ſtock? *Anſ.* £2265 : 8 : 4.

14. at 104$\frac{3}{8}$ *per cent.* South-Sea annuities—what is the purchaſe of 1797*l.* 14*s.*? *Anſ.* £1876 : 6 : 11$\frac{3}{4}$.

15. What is the purchaſe of of 2750*l.* 17*s.* South-Sea old annuities, at 102$\frac{5}{8}$ *per cent.*? *Anſ.* £2823 : 1 : 2$\frac{1}{4}$.

16 At 96$\frac{3}{4}$ *per cent.*—what is the purchaſe of 577*l.* 19*s.* bank annuities? *Anſ.* £559 : 3 : 3$\frac{3}{4}$.

17. At 124$\frac{5}{8}$ *per cent.*—what is the purchaſe of 758*l.* 17*s.* 10*d.* India ſtock? *Anſ.* £945 : 15 : 4$\frac{1}{2}$.

BKOKAGE

Is an allowance to brokers, for helping merchants or factors to perſons to buy or ſell them goods.

Rule. Divide the ſum given by 100, and take parts from the quotient with the rate *per cent.*

18. If I employ a broker to ſell goods for me, to the value of 2575*l.* 17*s* 6*d.*—what is the brokage at 4*s. per cent.*

25|75 : 17 : 6
20

15|17
12

2|10

4*s.* $\frac{1}{5}$ 25 : 15 : 2

Anſ. £5 : 3 : $0\frac{1}{4}$

19. What is the brokage of 796*l.* 14*s.* 7*d.* at 6*s. per cent.?*
Anſ. £2 : 7 : $9\frac{1}{2}$.

20. When a broker ſells goods to the amount of 7105*l.* 5*s.* 10*d.*—what may he demand for brokage, if he is allowed 5*s.* 6*d. per cent.* *Anſ.* £19 : 10 : $9\frac{1}{4}$.

21. If a broker is employed to buy a quantity of goods, to the value of 975*l.* 6*s.* 4*d.*—what is the brokage at 6*s*, 6*d.* *per cent.?* *Anſ.* £3 : 3 : $4\frac{1}{2}$.

When the time is $\frac{1}{4}$, or $\frac{1}{2}$, or $\frac{3}{4}$ of a year, beſides a number of years given,

Rule. Take parts of the intereſt for 1 year, which add to the intereſt of the ſeveral years given, and it will give the anſwer.

22. What is the intereſt of 354*l.* 10*s.* for 3 months, at 4 *per cent. per annum?*

554 : 10
4

22|18:0
20

3|60
12

m. 7|20
$3\frac{1}{4}$ 22 : 3 : 7

Anſ. 5 : 10 : $10\frac{3}{4}$

23. What is the intereſt of 336*l.* 15*s.* 6*d.* for $2\frac{3}{4}$ years, at 5 *per cent. per annum?*

336 : 15 : 16
5

16|83 : 17 : 6
20

16|77
12

9|30
4

1|20

$\frac{1}{2}$ $\frac{1}{2}$ 16 : 16 : $9\frac{1}{4}$
2

33 : 13 : $6\frac{1}{2}$
$\frac{1}{4}$ $\frac{1}{2}$ 8 : 8 : $4\frac{1}{2}$
4 : 4 : $2\frac{1}{4}$

Anſ. 46 : 6 : $1\frac{1}{4}$

24. What is the intereſt of 325*l.* 7*s.* 6*d.* at 6 *per cent. per annum,* for 3 years and a half? *Anſ.* £68 : 6 : 6¼

25. What is the intereſt of 547*l.* 2*s.* 4*d.* for five years and a half, at 4 *per cent. per annum?* *Anſ.* £120 : 7 : 3¼.

26. What is the intereſt of 257*l.* 5*s.* 1*d.* at 4 *per cent.* for a year and three quarters? *Anſ.* £18 : 0 : 1½.

27. What is the intereſt of 479*l.* 5*s.* for 5 years, and one quarter, at 5 *per cent. per annum?* *Anſ.* £125 : 16 : 1½

When the rate *per cent.* is ¼, ½, or ¾, *more than the pounds given in the rate,* proceed as in commiſſion, and it will give the anſwer for one year; and for ſeveral, proceed as in the laſt rule.

28. What is the intereſt of 175*l.* 17*s.* for 2 years and 3 quarters, 4½ *per cent. per annum?*

½ ½ 175 : 17
4

703 : 8 : 0
87 : 18 : 6

7|91 : 6 : 6
20

18|26
12

3|18

½ ½ 7 : 18 : 3
2

15 : 16 : 6
¼ ½ 3 : 19 : 1½
1 : 19 : 6¾

Anſ. £21 : 15 : 2¼

29. What is the intereſt of 397*l.* 9*s.* 5*d.* for 2 years and 1 quarter, at 3½ *per cent. per annum?* *Anſ.* £ 1 : 6*s.*

30. What is the intereſt of 576*l.* 2*s.* 7*d.* for 7 years and 1 quarter, at 4½ *per cent. per annum?* *Anſ.* £187 : 19 : 1½.

31. What is the intereſt of 279*l.* 13*s.* 8*d.* at 5¼ *per cent. per annum,* for 3 years and a half? *Anſ.* £51 : 7 : 10.

When the intereſt is required for any number of weeks.

RULE. As 52 weeks are to the intereſt of the given ſum for a year; ſo are the weeks given, to the intereſt required.

32. What is the intereſt of 379*l.* 13*s.* 2*d.* for 4 weeks, at 4 *per cent. per annum?*

w. £. s. d. w.
As 52 : 15 .. 3 .. 8½ :: 4
20
303
12
3644
4
14578
4
4)
52)58312(1121
52
12)280¼
63
52 2|0)2|3 : 4¼
111 1 : 3 : 4¼
104
72
52
20

379 : 13 : 2
4
15|18 : 12 : 8
20
3|72
12
8|72
4
2|88

Or thus; multiply by the number of weeks, and divide the product by 4 *and* 13, *being* 4 × 13 = 52 13)15 : 3 : 8½
1 : 3 : 4¼

☞ *As it is* 4 *weeks I do not multiply, but only divide by* 13.

33. What is the intereſt of 259*l.* 13*s.* 5*d.* for 20 weeks, at 5 *per cent. per annum?* *Anſ.* £4 : 19 : 10¼

34. What is the amount of 375*l.* 6*s.* 1*d.* for 12 weeks, at 4½ *per cent. per annum?* *Anſ.* £379 : 4 : 0¼

35. What is the amount of 256*l.* 5*s.* 3*d.* for 25 weeks, at 2¾ *per cent. per annum?* *Anſ.* £259 : 13*s.*

When the intereſt is for any number of days.

RULE. Multiply the pence of the principal by the days and rate *per cent.* for a dividend, cut off two figures on the right-hand, and divide by 365, the quotient will be the anſwer in pence. Or,

As 365 days, are to the intereſt of the given ſum for a year; ſo are the days given, to the intereſt required.

36. What is the intereſt of 240*l.* for 120 days, at 4 *per cent. per annum?*

```
       240
       240
     -----
     57600
       120
   -------
   6912000
         4
   ---------12)
365)276480|00(757
    2555        ----
    ----      2|0(6|:1
    2098      ---------
    1825         3:3:1¼
    ----
     2730
     2555
     ----
      175
        4
      ---
     )700(1
      365
      ---
      335
```

Or thus,

```
240 As 365 : 9 ·· 12 :: 120
        4         20
     ----       ----
     9|60        192
       20        120
     ----       -------2|0)
    12|00   365)23040(6|3
                2190    -------
                ----  £3:3:1¼
                1140
                1095
                ----
                  45
                  12
                ----
                )540(1
                 365
                 ---
                 175
                   4
                 ---
                )700(1
                 365
                 ---
                 335
```

37. What is the intereſt of 379*l.* 5*s.* 4*d.* for 3 years and 75 days, at 5 *per cent. per annum?* *Anſ.* £60 : 15 : 8.

38. At 5½ *per cent. per annum*,—what is the intereſt of 985*l.* 2*s.* 7*d.* for 5 years, 127 days? *Anſ.* £289 : 15 : 3.

39. What is the intereſt of 2726*l.* 1*s.* 4*d.* at 4½ *per cent. per annum*, for 3 years, 154 days? *Anſ.* £419 : 15 : 6¼

When the amount, time, and rate per cent. are given, to find the principal.

RULE. As the amount of 100*l.* at the rate and time given is to 100, ſo is the amount given to the principal required.

40. What principal being put to intereſt will amount to 402*l*. 10*s*. in 5 years, at 3 *per cent. per annum?*

3×5+100=£115:100::402 ·· 10

20 20

2300 8050

100

23|00)8050|00 *Anſ.* £350.

41. What principal being put to intereſt for 9 years will amount to 734*l*. 8*s*. at 4 *per cent. per annum? Anſ.* £540.

42. What principal being put to intereſt for 7 years, at 5 *per cent. per annum,* will amount to 334*l*. 16*s*. *Anſ.* 248,

When the principal, rate per cent. *and amount are given, to find the time.*

Rule. As the intereſt of the principal for one year is to one year, ſo is the whole intereſt to the time required.

43. In what time will 305*l*. amount to 402*l*. 10*s*. at 3 *per cent. per annum?*

350 As 10 ·· 10:1::52 ·· 10:5

3 20 20

10|50 210 21|0)105|0(5 years *Anſ.* 402:10

20 105 350: 0

10|00 . . . 752:10

44. In what time will 540*l*. amount to 734*l*. 8*s*. at 4 *per cent. per annum? Anſ.* 9 *years.*

45. In what time will 248*l*. amount to 334*l*. 16*s*. at 5 *per cent. per annum? Anſ.* 7 *years.*

When the principal, amount, and time are given, to find the rate per cent.

Rule. As the principal is to the intereſt for the whole time, ſo is 100*l*. to the intereſt for the ſame time. Divide that intereſt by the time, and the quotient will be the rate *per cent.*

46. At what rate *per cent.* will 350*l.* amount to 402*l.* 10*s.* in 5 years time?

350 As 350 : 52 ·· 10 :: 100 : 15

52 : 10 : 0

20

1050

100

35|0) 10500|0(300*s.* £15÷5=3 *per cent.*

47. At what rate *per cent.* will 248*l.* amount to 334*l.* 16*s.* in 7 years time? *Anſ.* 5 *per cent.*

48. At what rate *per cent.* will 340*l.* amount to 734*l.* 8*s.* in 9 years time? *Anſ.* 4 *per cent.*

COMPOUND INTEREST

Is that which ariſes both from the principal and intereſt; that is, when the intereſt on money becomes due, and not paid, the ſame intereſt is allowed on that intereſt unpaid, as was on the principal before.

Rule 1. Find the firſt year's intereſt, which add to the principal, then find the intereſt of that ſum, which add as before; and ſo on for the number of years.

2. Subtract the given ſum from the laſt amount, and it will give the compound intereſt required.

Examples.

1. What is the compound intereſt of 500*l.* forborne 3 years, at 5 *per cent. per annum?*

500
5
25|00

500
25
525 *1ſt year.*
5
26|25
20
5|00

525
26 : 5
551 : 5 *2d year.*
5
27|56 : 5
20
11|25
12
3|00

551 : 5
27 : 11 : 3
578 : 16 : 3 *3d year.*
500 : 0 : 0 *prin. ſub.*
78 : 16 : 3 = *intereſt for 3 years.*

2. What is the amount of 400*l.* forborne 3½ years, at 6 *per cent. per ann.* compound intereſt? *Anſ.* £490 : 13 : 11¼.

3. What will 650l. amount to in 5 years, at 5 *per cent. per annum*, compound intereſt? *Anſ.* £829 : 11 : 7½.

4. What is the amount of 550l. 10s. for 3 years and 6 months, at 6 *per cent. per annum*, compound intereſt?
Anſ. £675 : 6 : 5.

5. What is the compound intereſt of 764l. for 4 years, and 9 months, at 6 *per cent. per annum?* *Anſ.* £243 : 18 : 8.

6. What is the compound intereſt of 57l. 10s. 6d. for 5 years, 7 months, and 15 days, at 5 *per cent. per annum?*
Anſ. £18 : 3 : 8¼.

7. What is the compound intereſt of 259l. 10s. for 3 years, 9 months, and 10 days, at 4½ *per cent. per annum?*
Anſ. £46 : 19 : 10½

REBATE *or* DISCOUNT

IS the abating ſo much money on a debt to be received before it is due, as that money, if put to intereſt, would gain in the ſame time, and at the ſame rate. As 100l. preſent money would diſcharge a debt of 105l. to be paid a year to come, rebate being made at 5 *per cent.*

Rule. As 100l. with the intereſt for the time given is to that intereſt, ſo is the ſum given to the rebate required.

Subtract the rebate from the given ſum, and the remainder will be the preſent worth.

Examples.

1. What is the diſcount and preſent worth of 487l. 12s. for 6 months, at 6 *per cent. per annum?*

6 *m.* ½)6 As 103 : 3 :: 487 .. 12
20 20
3
100 2060 9752
3
103
206|0)2925|6(14l. 4s. *rebate.*
487 : 12 206
14 : 4
865
Anſ. 473 : 8 *preſent worth.* 824
416=4s.

2. What is the preſent payment of 357*l.* 10*s.* which was agreed to be paid 9 months hence, at 5 *per cent. per annum?*
Anſ. £344 : 11 : 7.

3. What is the diſcount of 275*l* 10*s.* for 7 months, at 5 *per cent. per annum?* *Anſ.* £7 : 16 : 1¾.

4. Bought goods to the value of 109*l.* 10*s.* to be paid at 9 months—what preſent money will diſcharge the ſame, if I am allowed 6 *per cent. per annum* diſcount?
Anſ £104 : 15 : 8½.

5. What is the preſent worth of 527*l.* 9*s.* 1*d.* payable 7 months hence at 4¼ *per cent.?* *Anſ.* £514 : 13 : 10¾.

6. What is the diſcount of 85*l.* 10*s.* due September the 8th, this being July the 4th, rebate at 5 *per cent. per annum?*
Anſ. 15*s.* 3½*d.*

7. Sold goods for 875*l.* 5*s.* 6*d.* to be paid 5 months hence—what is the preſent worth at 4½ *per cent.?*
Anſ. £859 : 3 : 4.

8. What is the preſent worth of 500*l.* payable in 10 months, at 5 *per cent. per annum?* *Anſ.* £480.

9. How much ready money can I receive for a note of 75*l.* due 15 months hence at 5 *per cent.?*
Anſ. £70 : 11 : 9¼.

10. What will be the preſent worth of 150*l.* payable at three 4 months; *i. e.* one third at 4 months, one third at 8 months, and one third at 12 months, at 5 *per cent.* diſcount?
Anſ. £145 : 3 : 9¼.

11. Sold goods to the value of 575*l.* 10*s.* to be paid at two 3 months—what muſt be diſcounted for the preſent payment at 5 *per cent.?* *Anſ.* £10 : 11 : 4¾.

12. What is the preſent worth of 500*l.* at 4 *per cent.* 100*l.* being to be paid down, and the reſt at two 6 months?
Anſ. £488 : 7 : 9.

EQUATION *of* PAYMENTS

IS, when ſeveral ſums are due at different times, to find a mean time for paying the whole debt; to do which, this is the common

RULE. Multiply each term by its time, and divide the ſum of the products by the whole debt, the quotient is accounted the mean-time.

Examples.

1. A owes B 200*l.* whereof 40*l.* is to be paid at 3 months, 60*l.* at 5 months, and 100*l.* at 10 months; at what time may the whole debt be paid together, without prejudice to either?

$$\begin{array}{rcrcr}
\text{£.} & & \textit{m.} & & \\
40 & \times & 3 & = & 120 \\
60 & \times & 5 & = & 300 \\
100 & \times & 10 & = & 1000 \\
\hline
 & & 2|00) & & 14|20 \\
\hline
\end{array}$$

7 months, $\frac{1}{10}$.

2. B owes C 800*l.* whereof 200*l.* is to be paid at 3 months, 100*l.* at 4 months, 300*l.* at 5 months, and 200*l.* at 6 months; but they agreeing to make but one payment of the whole—I demand what that time muſt be?

Anſ. 4 *months* 18 *days.*

3. I bought of K a quantity of goods to the value of 360*l.* which was to have been paid as follows: 120*l.* at 2 months, 200*l.* at 4 months, and the reſt at 5 months; but we afterwards agreed to have it paid at one mean-time—the time is demanded? *Anſ.* 3 *months,* 13 *days.*

4. A merchant bought goods to the value of 500*l.* to pay 100*l.* at the end of 3 months, 150*l.* at the end of 6 months, and 250*l.* at the end of 12 months; but afterwards they agreed to diſcharge the debt at one payment; at what time was this payment made? *Anſ.* 8 *months,* 12 *days.*

5. H is indebted to L a certain ſum, which is to be paid at 6 different payments, that is, $\frac{1}{4}$ at 2 months, $\frac{1}{8}$ at 3 months, $\frac{1}{8}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{8}$ at 6 months, and the reſt at 7 months; but they agree that the whole ſhall be paid at one equated time—what is that time?

Anſ. $4\frac{1}{4}$ *months.*

6. A is indebted to B 120*l.* whereof $\frac{1}{2}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the reſt at 9 months,—what is the equated time of the whole payments?

Anſ. 5 *months,* 7 *days.*

BARTER

IS the exchanging one commodity for another, and informs the traders ſo to proportion their goods, that neither may ſuſtain loſs.

RULE. 1*ſt*, Find the value of that commodity whoſe quantity is given; then find what quantity of the other, at the rate propoſed, you may have for the ſame money.

2*dly*, When one has goods at a certain price, *ready money*, but in bartering advances it to ſomething more, find what the other ought to rate his goods at, in proportion to that advance, and then proceed as before.

EXAMPLES.

1. What quantity of chocolate, at 4*s*. *per* lb. muſt be delivered in barter for 2 cwt. of tea, at 9*s*. *per* lb.?

2 cwt.
112
224
9
4|2016 *the value of the tea.*
504 lb. of *chocolate*.

2. A and B barter; A hath 20 cwt. of prunes, at 4*d*. *per* lb. ready money, but in barter will have 5*d*. *per* lb. and B hath hops worth 32*s*. *per* cwt. ready money; what ought B to rate his hops at in barter, and what quantity muſt be given for the 20 cwt. of prunes?

112 As 4 : 5 :: 32
20 5
s.
40 2240 4)160
12 5
cwt.qr.lb 40S.
48|0) 1120|0(23:1:9$\frac{16}{48}$ *Anſ.*
96
160
144
16=1 *qr.* 9$\frac{16}{48}$*lb.*

3. How much tea, at 9*s*. *per* lb. can I have in barter for 4 cwt. 2 qrs. of chocolate, at 4*s*. *per* lb.? *Anſ. 2 cwt.*

4. Two merchants barter; A hath 20 cwt. of cheeſe, at 21*s*. 6*d*. *per* cwt. B hath eight pieces of Iriſh cloth, at 3*l*. 14*s*. *per* piece—I deſire to know who muſt receive the difference, and how much?

Anſ. B *muſt receive of* A £8 : 2*s*.

5. A and B barter; A hath $3\frac{1}{2}$lb. of pepper, at $13\frac{1}{2}$*d*. *per* lb. B hath ginger at $15\frac{1}{4}$*d*. *per* lb.—how much ginger muſt he deliver in barter for the pepper? *Anſ.* 3*lb*. $1\frac{35}{61}$*oz*.

6. How many dozen of candles, at 5*s*. 2*d*. *per* dozen, muſt be delivered in barter for 3 cwt. 2 qrs. 16lb. of tallow, at 37*s*. 4*d*. *per* cwt. *Anſ.* 26 *doz*. 3*lb*.

7. A hath 608 yards of cloth, worth 14*s*. *per* yard, for which B gives him 125*l*. 12*s*. in ready money, and 85 cwt. 2 qrs. 24lb. of bees-wax. The queſtion is—what did B reckon his bees-wax at *per* cwt.? *Anſ.* £3 : 10*s*.

8. A and B barter; A hath 320 dozen of candles, at 4*s*. 6*d*. *per* dozen, for which B gives him 30*l*. in money, and the reſt in cotton, at 8*d*. *per* lb.—I deſire to know how much cotton B gave A beſides the money?

Anſ. 11 *cwt*. 1 *qr*.

9. If B hath cotton, at 1*s*. 2*d*. *per* lb.—how much muſt he give A for 114lb. of tobacco, at 6*d*. *per* lb.?

Anſ. $48\frac{12}{14}$*lb*.

10. C hath nutmegs worth 7*s*. 6*d*. *per* lb. ready money, but in barter will have 8*s*. *per* lb. and D hath leaf-tobacco worth 9*d*. *per* lb. ready money—how much muſt D rate his tobacco at *per* lb. that his profit may be equivalent with C's? *Anſ.* $9\frac{1}{2}$*d*. $\frac{36}{90}$.

PROFIT *and* LOSS

IS a rule that diſcovers what is got or loſt in the buying or ſelling of goods; and inſtructs us to riſe or fall our price, ſo as to gain or loſe ſo much *per cent*. or otherwiſe.

The queſtions in this rule are performed by the Rule of Three.

EXAMPLES.

1. If a yard of cloth is bought for 11*s.* and ſold for 12*s.* 6*d.*—what is the gain *per cent.?*

```
As 11:1··6::100
       12       20
       —       ———
       18     2000
                18
12··6          ———
11··0    11)36000
————     ————————
 1··6     12)3272
————         ———
        2|0)27|2 : 8
        ————————————
```

Anſ. £13 : 12 : 8$\frac{8}{11}$.

2. If 60 ells of Holland coſt 18*l.*—what muſt 1 ell be ſold for to gain 8 *per cent.?*

```
As 100:18::108
        108
———————————12×5=60
1|00)19|44
      20|12)19··8··9½
      ——    ——————————
      8|80  5)1··12··4¾
      12    ——————————
      ——          6··5¾
      9|60
         4
      ——
      2|40
```

Anſ. 6*s.* 5$\frac{3}{4}$*d.*

3. If 1lb. of tobacco coſt 16*d.* and is ſold for 20*d.*—what is the gain *per cent.?* *Anſ.* £25.

4. If a parcel of cloth be ſold for 560*l.* and at 12*l. per cent.* gain—what was the prime coſt? *Anſ.* £500.

5. If a yard of cloth is bought for 13*s.* 4*d.* and ſold again for 16*s.*—what is the gain *per cent.?* *Anſ.* £20.

6. If 112lb. of iron coſt 27*s.* 6*d.*—what muſt 1 cwt. be ſold for to gain 15*l. per cent.?* *Anſ.* £1:11:7$\frac{1}{2}$.

7. If 375 yards of broad cloth be ſold for 490*l.* and 20 *per cent.* profit—what did it coſt *per* yard? *Anſ.* £1:1:9$\frac{1}{4}$.

8. Sold 1 cwt. of hops for 60*l.* 15*s.* at the rate of 25 *per cent.* profit—what would have been the gain *per cent.* if I had ſold them for 8*l. per* cwt.? *Anſ.* £48 : 2 : 11$\frac{1}{2}$.

9. If 90 ells of cambric coſt 60*l.*—how muſt I ſell it at *per* yard to gain 18*l. per cent.?* *Anſ.* 12*s.* 7*d.*

10. A plumber ſold 10 fother of lead for 204*l.* 15*s.* (the fother being 19$\frac{1}{2}$ cwt.) and gained after the rate of 12*l.* 10*s.* *per cent.*—what did it coſt him *per* cwt.? *Anſ.* 18*s.* 8*d.*

11. Bought 436 yards of cloth, at the rate of 8*s.* 6*d. per* yard, and ſold it for 10*s.* 4*d. per* yard—what was the gain of the whole? *Anſ.* £39:19:4.

12. Paid 69*l.* for one ton of ſteel, which is retailed at 6*d. per* lb.—what is the profit or loſs by the ſale of 14 tons? *Anſ.* £182 *loſs.*

13. Bought 124 yards of linen for 32*l.*—how ſhould the ſame be retailed *per* yard to gain 15*l. per cent.?*

Anſ. 5*s.* 11$\frac{28}{124}$.

14. Bought 249 yards of cloth, at 3*s.* 4*d. per* yard, retailed the ſame at 4*s.* 2*d. per* yard—what is the profit in the whole, and how much *per cent.?*

Anſ. £10:7:6 *profit, and* 25 *per cent.*

FELLOWSHIP

Is when two or more join their ſtocks and trade together, ſo to determine each perſon's particular ſhare of the gain or loſs, in proportion to his principal in the joint-ſtock.

By this rule a bankrupt's eſtate may be divided amongſt his creditors; as alſo legacies may be adjuſted when there is a deficiency of aſſets or effects.

Fellowship *is either with or without* **time.**

FELLOWSHIP WITHOUT TIME.

Rule. As the whole ſtock is to the whole gain or loſs, ſo is each man's ſhare in ſtock, to his ſhare of the gain or loſs.

Proof. Add all the ſhares together, and the ſum will be equal to the given gain or loſs—but the ſureſt way is, as the whole gain or loſs is to the whole ſtock, ſo is each man's ſhare of the gain or loſs to his ſhare in ſtock.

Examples.

1. Two merchants trade together; A put into ſtock 20*l.* and B 40*l.* they gained 50*l.*—what is each perſon's ſhare thereof?

$$\begin{array}{ccc}
 & 20+40=60 & \\
\text{As } 60:50::20 & \text{As } 60:50::40 & 33:\ 6:8 \text{ B's } \textit{ſhare}. \\
20 & 40 & \underline{16:13:4 \text{ A's}.} \\
\underline{} & \underline{} & \underline{\underline{50:\ 0:0}}\ \textit{Proof}. \\
6|0)100|0 & 6|0)200|0 & \\
\underline{\underline{\pounds 16:13:4}} & \underline{\underline{\pounds 33:6:8}} &
\end{array}$$

2. Three merchants trade together, A, B, and C; A puts in 20*l.* B 30*l.* and C 40*l.* they gained 180*l.*—what is each man's part of the gain? *Anſ.* A£40; B£60; C£80.

3. A, B, and C, enter into partnerſhip: A puts in 364*l.* B 482*l.*

3. A, B, and C, enter into partnerſhip: A puts in 364*l.* B. 482*l* and C 500*l.* and they gained 867*l.*—what is each man's ſhare in proportion to his ſtock?

Anſ. A £234 : 9 : $3\frac{1}{4}$—*rem.* 70; B £310 : 9 : 5—*rem.* 248; C 322 : 1 : $3\frac{1}{2}$—*rem.* 1028.

4. Four merchants, B, C, D, and E, made a ſtock: B put in 227*l.* C 349*l.* D 115*l.* and E 439*l.* in trading they gained 428*l.*—I demand each merchant's ſhare of the gain?

Anſ. B. £85 : 19 : $6\frac{3}{4}$—690; C £132 : 3 : 9—120; D £43 : 11 : $1\frac{3}{4}$—250; E £166 : 5 : $6\frac{1}{4}$.—70.

5. Three perſons, D, E, and F, join in company: D's ſtock was 750*l.* E's 460*l.* and F's 500*l.* and at the end of 12 months they gained 684*l.*—what is each man's particular ſhare of the gain? *Anſ.* D £300; E £184; and F £200.

6. A merchant is indebted to B 275*l.* 14*s*; to C 304*l.* 7*s.*; to D 152*l.*; and to E 104*l.* 6*s.*; but upon his deceaſe his eſtate is found to be worth but 675*l.* 15*s.*—how muſt it be divided among his creditors?

Anſ. B's £222 : 15 : 2—6584; C's £245 : 18 : $1\frac{1}{2}$—15750; D's £122 : 16 : $2\frac{3}{4}$—12227; and E's £84 : 5 : 5—15620.

7. Four perſons trading togethar in a joint ſtock, of which A has $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, and D $\frac{1}{6}$, and at the end of 6 months they gain 100*l.*—what is each man's ſhare of the ſaid gain? *Anſ.* £35 : 1 : 9—48; B £26 : 6 : $3\frac{3}{4}$—36. C £21 : 1 : $0\frac{1}{2}$—120; *and* D £17 : 10 : $10\frac{1}{2}$—24.

8. Two perſons purchaſed an eſtate of 1700*l.* *per annum*, freehold, for 27200*l.* when money was at 6 *per cent.* intereſt, and 4*s.* *per* pound land-tax, whereof D paid 15000*l.* and E the reſt; ſometime after the intereſt of the money falling to 5 *per cent.* and 2*s.* *per* pound land-tax, they ſell the ſaid eſtate for 24 year's purchaſe—I deſire to know each perſon's ſhare? *Anſ.* D £22500; E £18500.

9. D, E, and F join their ſtocks in trade; the amount of their ſtocks is 647*l.* and are in proportion as 4, 6, and 8, are to one another, and the amount of this gain is equal to D's ſtock—what is each man's ſtock and gain?

D's *ſtock*, 143 : 15 : $6\frac{12}{23}$ *gain*, £31 : 19 : 0. 184036.
E's —— 215 : 13 : 4 —— 47 : 18 : 6. 414080.
F's —— 287 : 1 : $1\frac{11}{43}$ —— 63 : 18 : 0. 506098.

10. D, E, and F, join ſtocks in trade: The amount of their ſtocks was 100*l.* D's gain 3*l.* E's 5*l.* and F's 8*l.*—what was each man's ſtock?

Anſ. D's *ſtock* £18 : 15*s.*; E's £31 : 5*s.*; *and* F's £50.

FELLOWSHIP WITH TIME

Rule. As the ſum of the products of each man's money and time is to the whole gain or loſs, ſo is each man's product to his ſhare of the gain or loſs.

Proof. As in Fellowſhip Without Time.

Examples.

1. D and E enter into partnerſhip; D puts in 40*l.* for 3 months, and E 75*l.* for 4 months, and they gained 70*l.*—what is each man's ſhare of the gain?

Anſ. D £20; E £50.

40×3=120	As 420 : 70 : : 120	As 420 : 70 : : 300
75×4=300	120	300
420	42|0)840|0(20	42|0)2100|0(50
	84	210

2. Three merchants join in company; D puts in ſtock 195*l.* 14*s.* for 3 months, E 179*l.* 18*s.* 3*d.* for 5 months, and F 59*l.* 14*s.* 10*d.* for 11 months, they gained 364*l.* 18*s.*—what is each man's part of the gain?

Anſ. D's £102 : 6 : 4—5008 ; E's £148 : 1 : 1½—482802 ; *and* F's £114 : 10 : 6¼—14707.

3. Three merchants join in company for 18 months ; D put in 500*l.* and at 5 months end took out 200*l.* at 10 months end put in 300*l.* and at the end of 14 months took out 130*l.* E puts in 400*l.* and at the end of three months 270*l.* more ; at 9 months he takes out 140*l.* but puts in 100*l.* at the end of 12 months, and withdraws 99*l.* at the end of 15 months. F puts in 900*l.* and at 6 months took out 200*l.* ; at the end of 11 months, put in 500*l.* but takes out that and 100*l.* more at the end of 13 months. They gained 200*l.*—I deſire to know each man's ſhare of the gain?

Anſ. D £50 : 7 : 6—21720 ; E £62 : 12 : 5¼—29859 ; *and* F £87 : 0 : 0¼—14167.

4. D, E, and F, hold a piece of ground in common, for which they are to pay 36*l.* 10*s.* 6*d.* D puts in 23 oxen 27 days ; E 21 oxen 35 days ; and F 16 oxen 23 days ;—what is each man to pay of the ſaid rent?

Anſ. D £13 : 3 : 1½—624 ; E £15 : 11 : 5—1688 ; *and* F £7 : 15 : 11—1136.

ALLIGATION.

ALLIGATION *is either* MEDIAL *or* ALTERNATE.

ALLIGATION MEDIAL

IS when the price and quantities of ſeveral ſimples are given to be mixed, to find the mean price of that mixture.

RULE. As the whole compoſition is to its total value, ſo is any part of the compoſition to its mean price.

PROOF. Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the ſeveral quantities at their reſpective prices, the work is right.

EXAMPLES.

1. A farmer mixed 20 buſhels of wheat, at 5*s.* *per* buſhel, and 36 buſhels of rye, at 3*s.* *per* buſhel, with 40 buſhels of barley at 2*s.* *per* buſhel—I deſire to know the worth of a buſhel of this mixture?

$$\begin{array}{rcr} 20 \times 5 & = & 100 \\ 36 \times 3 & = & 108 \\ 40 \times 2 & = & 80 \\ \hline 96 & & 288 \\ \hline\hline \end{array}$$

As 96 : 288 :: 1 : 3

Anſ. 3*s.*

2. A vintner mingles 15 gallons of Canary, at 8*s.* *per* gallon, with 20 gallons, at 7*s.* 4*d.* *per* gallon, 10 gallons of Sherry, at 6*s.* 8*d.* *per* gallon, and 24 gallons of white wine at 4*s.* *per* gallon—what is the worth of a gallon of this mixture? *Anſ.* 6*s.* 2½*d.* $\frac{46}{69}$.

3. A grocer mingled 4 cwt of ſugar at 56*s.* *per* cwt. 7 cwt. at 43*s.* *per* cwt. and 5 cwt. at 37*s.* *per* cwt.—I demand the price of 2 cwt of this mixture? *Anſ.* £4 : 8 : 9.

4. A maltſter mingles 30 quarters of brown malt at 28*s.* *per* quarter, with 46 quarters of pale, at 30*s.* *per* quarter, and 24 quarters of high-dried ditto, at 25*s.* *per* quarter—what is the value of 8 buſhels of this mixture?

Anſ. £1 : 8 : 2¼*d.* $\frac{6}{10}$.

5. If I mix 27 buſhels of wheat, at 5*s.* 6*d.* *per* buſhel, with the ſame quantity of rye, at 4*s.* *per* buſhel, and 14 buſhels of barley, at 2*s.* 8*d.* *per* buſhel—what is the worth of a buſhel of this mixture? *Anſ.* 4*s.* 3¾*d.* $\frac{28}{68}$.

6. A grocer mingled 3 cwt. of ſugar, at 56*s.* *per* cwt. 6 cwt. at 1*l.* 17*s.* 4*d.* *per* cwt. and 3 cwt. at 3*l.* 14*s.* 8*d.* *per* cwt.—what is 1 cwt. of this mixture worth? *Anſ.* 2 : 11 : 4.

7. A mealman has flour of ſeveral ſorts, and would mix 3 buſhels at 3*s.* 5*d.* *per* buſhel, 4 buſhels at 5*s.* 6*d.* *per* buſhel, and 5 buſhels at 4*s.* 8*d.* *per* buſhel—what is the worth of a buſhel of this mixture? *Anſ* 4*s.* $7\frac{1}{2}$*d.* $\frac{4}{12}$.

8. A vintner mixes 20 gallons of Port, at 5*s.* 4*d.* *per* gallon, with 12 gallons of white wine at 5*s.* *per* gallon, 30 gallons of Liſbon, at 6*s.* *per* gallon, and 20 gallons of Mountain, at 4*s.* 6*d.* *per* gallon—what is a gallon of this mixture worth? *Anſ.* 5*s.* $3\frac{3}{4}$*d.* $\frac{50}{82}$.

9. A farmer mingled 20 buſhels of wheat, at 5*s.* *per* buſhel, and 36 buſhels of rye, at 3*s.* *per* buſhel, with 40 buſhels of barley, at 2*s.* *per* buſhel—I deſire to know the worth of a buſhel of this mixture? *Anſ.* 3*s.*

10. A perſon mixing a quantity of oats, at 2*s.* 6*d.* *per* buſhel, with the like quantity of beans, at 4*s.* 6*d.* *per* buſhel—would be glad to know the price of one buſhel of that mixture? *Anſ.* 3*s.* 6*d.*

11. A refiner, having 12 lb. of ſilver bullion, of 6 oz. fine, would melt it with 8 lb. of 7 oz. fine, and 10 lb. of 8 oz. fine—I require the fineneſs of 1 lb. of that mixture? *Anſ.* 6 *oz.* 18 *dwt.* 16 *grs.*

12. If with 40 buſhels of corn, at 4*s.* *per* buſhel, there are mixed 10 buſhels at 6*s.* *per* buſhel, 30 buſhels at 5*s.* *per* buſhel, and 20 buſhels at 3*s.* *per* buſhel—what will 10 buſhels of that mixture be worth? *Anſ.* £2 : 3*s.*

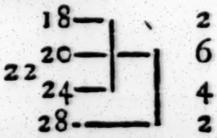
13. A tobacconiſt would mix 50 lb. of tobacco, at 11*d.* *per* lb. with 30 lb. at 14*d.* *per* lb. 25 lb. at 22*d.* *per* lb. and 37 lb. at 2*s.* *per* lb.—what will 1 lb. of this mixture be worth? *Anſ.* $16\frac{3}{4}$*d.* $\frac{118}{142}$.

ALLIGATION ALTERNATE

Is when the prices of ſeveral things are given, to find ſuch quantities of them to make a mixture, that may bear a price propounded.

In ordering the rates and given price, obſerve,

1. Place them one under the other, and the propounded price or mean rate at the left hand of them, thus,



2. Link the ſeveral rates together by 2 and 2, always obſerving to join a greater and a leſs than the mean.

3. Againſt each extreme place the difference of the mean and its yoke-fellow.

When the prices of the ſeveral ſimples and the mean rate are given without any quantity, to find how much of each ſimple is required to compaſs the mixture.

Rule. Take the difference between each price and the mean rate, and ſet them alternately, they will be the anſwer required.

Proof. By Alligation Medial.

Examples.

1. A vintner would mix four ſorts of wine together, of 18*l.* 20*d.* 24*d.* and 28*d.* *per* quart—what quantity of each muſt he take to ſell the mixture at 22*d.* *per* quart?

	Anſwer		*Proof.*		*Or thus,*		*Proof.*
22	18	2 of 18*d.* =	36*d.*	22	18	6 of 18*d.* =	108*d.*
	20	6 of 20*d.* =	120		20	2 of 20*d.* =	40
	24	4 of 24*d.* =	96		24	2 of 24*d.* =	48
	28	2 of 28*d.* =	56		28	4 of 28*d.* =	112
		14	)308			14	)308
			22*d.*				22*d.*

Note, *Queſtions in this rule admit of a great variety of anſwers, according to the manner of linking them.*

2. A grocer would mix ſugar at 4*d.* 6*d.* and 10*d.* *per* lb. ſo as to ſell the compound for 8*d.* *per* lb.--what quantity of each muſt he take? *Anſ.* 2*lb.* at 4*d.*; 2*lb.* at 6*d.*; and 6*lb.* at 10*d.*

3. I deſire to know how much tea, at 16*s.* 14*s.* 9*s.* and 8*s.* *per* lb. will compoſe a mixture worth 10*s.* *per* lb.?

Anſ. 1*lb. at* 16*s.*; 2*lb. at* 14*s.*; 6*lb. at* 9*s.*; *and* 4*lb. at* 8*s.*

4. A farmer would mix as much barley at 3*s.* 6*d.* *per* buſhel, rye at 4*s.* *per* buſhel, and oats at 2*s.* *per* buſhel, as to make a mixture worth 2*s.* 6*d.* *per* buſhel—how much is that of each ſort? *Anſ.* 6 *of barley*; 6 *of rye*; *and* 30 *of oats.*

5. A grocer would mix raiſins of the ſun at 7*d.* *per* lb. with Malagas at 6*d.* and Smyrnas at 4*d.* *per* lb.—I deſire to know what quantity of each ſort he muſt take to ſell them at 5*d.* *per* lb.? *Anſ.* 1*lb. raiſins of the ſun*; 1*lb. of Malaga, and* 3*lb. Smyrnas.*

6. A tobacconiſt would mix tobacco of 2*s.* 18*d.* and 15*d.* *per* lb. ſo as the compound may bear a price of 1*s.* 8*d.* *per* lb.—what quantity of each muſt he take?

Anſ. 7*lb.* *at* 2*s.*; 4*lb.* *at* 1*s.* 6*d.*; *and* 4*lb.* *at* 1*s.* 3*d.*

ALTERNATION PARTIAL

Is when the prices of all the ſimples, the quantity of but one of them and the mean rate, are given to find the ſeveral quantities of the reſt, in proportion to that given.

Rule. Take the difference between each price, and the mean rate as before. Then,

As the difference of that ſimple, whoſe quantity is given is to the reſt of the differences ſeverally, ſo is the quantity given to the ſeveral quantities required.

Examples.

1. A tobacconiſt being determined to mix 20lb. of tobacco, at 15*d.* *per* lb. with others at 16*d.* *per* lb. 18*d.* *per* lb. and 22*d.* *per* lb.—how many pounds of each ſort muſt he take to make one pound of that mixture worth 17*d.*?

			Anſ	*Proof.*	
17	15	5	20lb.	at 15*d.* = 300*d.*	As 5 : 1 :: 20 : 4
	16	1	4lb.	at 16*d.* = 64*d.*	As 5 : 1 :: 20 : 4
	18	1	4lb.	at 18*d.* = 72*d.*	As 5 : 2 :: 20 : 8
	22	2	8lb.	at 22*d.* = 176*d.*	

Anſ. 36 lb : 612 :: 1 lb. : 17*d.*

2. A farmer would mix 20 buſhels of wheat, at 60*d.* *per* buſhel, with rye at 36*d.* barley at 24*d.* and oats at 18*d.* *per* buſhel.—how much muſt he take of each ſort to make the compoſition worth 32*d.* *per* buſhel?

Anſ. 20 *buſhels of wheat*; 35 *buſhels of rye*; 70 *buſhels of barley*; *and* 10 *buſhels of oats.*

3. A perſon is deſirous of mixing wheat at 4*s.* *per* buſhel, rye at 3*s.* *per* buſhel, and barley at 2*s.* *per* buſhel, with 12 buſhels of oats at 18*d.* *per* buſhel—I would be glad to know how many buſhels of each ſort he muſt take, to make the compoſition worth 3*s.* 6*d.* *per* buſhel?

Anſ. 96 *buſhels of wheat*; 12 *buſhels of rye*; 12 *of barley*; *and* 12 *of oats.*

4. A diſtiller would mix 40 gallons of French brandy at 12*s.* *per* gallon, with Engliſh at 7*s.* and ſpirits at 4*s.* *per*

gallon.—what quantity of each ſort muſt he take, to afford it for 8*s*. *per* gallon?

Anſ. 40 *gallons French*; 32 *Engliſh*; *and* 32 *ſpirits.*

5. A grocer would mix teas of 12*s*. 10*s*. and 6*s*. with 20lb. at 4*s*. per lb.—how much of each ſort muſt he take to make the compoſition worth 8*s*. *per* lb.?

Anſ. 20*lb. at* 4*s*.; 10*lb. at* 6*s*.; 10*lb. at* 6*s*.; *and* 20*lb. at* 12*s.*

6. A wine merchant is deſirous of mixing 18 gallons of Canary at 6*s*. 9*d*. *per* gallon, with Malaga at 7*s*. 6*d*. *per* gallon; Sherry at 5*s*. *per* gallon; and white wine at 5*s*. 3*d*. *per* gallon—how much of each ſort muſt he take, that the mixture may be ſold for 6*s*. *per* gallon?

Anſ. 18 *gallons of Canary*; 31½ *of Malaga*; 13½ *of Sherry, and* 27 *of white wine.*

ALTERNATION TOTAL

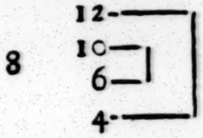
Is when the price of each ſimple, the quantity to be compounded, and the mean rate, are given to find how much of each ſort will make the quantity.

Rule. Take the difference between each price, and the mean rate, as before; then,

As the ſum of the difference is to each particular difference, ſo is the quantity given to the quantity required.

Examples.

1. A grocer has four ſorts of ſugar, *viz.* 12*d*. 10*d*. 6*d*. and 4*d*. *per* lb. and would make a compoſition of 144 lb. worth 8*d*. *per* lb.—I deſire to know what quantity of each he muſt take?



4—48 at 12*d*.=576 As 12 : 4 :: 144 : 48
2—24 at 10*d*.=240 As 12 : 2 :: 144 : 24
2—24 at 6*d*.=144
4—48 at 4*d*.=192

12 144)1152(8*d*.

2. A druggiſt having four ſorts of tea, of 5*s*. 6*s*. 8*s*. and 9*s*. *per* lb. would have a compoſition of 87 lb. worth 7*s*. *per* lb.—what quantity muſt there be of each?

Anſ. 14½*lb. of* 5*s*.; 29*lb. of* 6*s*.; 29*lb. of* 8*s*.; *and* 14½*lb. of* 9*s*.

3. A vintner had four ſorts of wine, *viz.* white wine, at 4*s.* *per* gallon; Flemiſh at 6*s.* *per* gallon; Malaga at 8*s.* *per* gallon; and Canary at 10*s.* *per* gallon; would make a mixture of 60 gallons, to be worth 5*s.* *per* gallon.—what quantity of each muſt he take?

Anſ. 45 *gallons of white wine;* 5 *gallons of Flemiſh;*
5 *gallons of Malaga, and* 5 *gallons of Canary.*

4. A grocer having four ſorts of currants, of 11*d.* 9*d.* 6*d.* and 4*d.* *per* pound, is deſirous of making a compoſition of 240lb. worth 8*d.* *per* lb.—how much of each muſt he take?

Anſ. 96*lb. at* 11*d.*; 48*lb. at* 9*d.*; 24*lb. at* 6*d.*; *and* 72*lb. at* 4*d.*

5. A ſilverſmith hath four ſorts of gold, *viz.* of 24 carats fine, of 22, 20, and 15 carats fine; would make as much of each ſort together, ſo as to have 42 oz. of 17 carats fine—how much muſt he take of each?

Anſ. 4 *of* 24; 4 *of* 22; 4 *of* 20; *and* 30 *of* 15 *carats fine.*

6. A druggiſt having ſome drugs of 8*s.* 5*s.* and 4*s.* *per* lb. made them into two parcels; one of the 28 lb. at 6*s.* *per* lb. the other of 42 lb. at 7*s.* *per* lb.—how much of every ſort did he take for each parcel?

Anſ. 12 *lb. of* 8*s.*	*Anſ.* 30*lb. of* 8*s.*
8*lb. of* 5*s.*	6*lb. of* 5*s.*
8*lb. of* 4*s.*	6*lb. of* 4*s.*
—	—
28*lb. at* 6*s. per lb.*	42*lb. at* 7*s. per lb.*

POSITION; *or, the* RULE *of* FALSE

IS a rule that, by falſe or ſuppoſed numbers, taken at pleaſure, diſcovers the true one required. It is divided into two parts; SINGLE and DOUBLE.

SINGLE POSITION

Is, by uſing one ſuppoſed number, and working with it as the true one; you find the real number required, by the following.

RULE. As the total of the errors is to the true total, ſo is the ſuppoſed number to the true one required.

PROOF. Add the ſeveral parts of them together, and if it agrees with the ſum, it is right.

EXAMPLES.

1. A ſchoolmaſter being aſked how many ſcholars he had ſaid, If I had as many, half as many, and one quarter as many more, I ſhould have 88—how many had he? *Anſ.* 32.

Suppoſe he had -	40	As 110:88::40	32
as many - - -	40	40	32
half as many	20	—	16
$\frac{1}{4}$ *as many* - -	10	11|0)352|0(32	8
	—	33	—
	110	—	88 *proof.*
		22	
		—	
		..	

2. A perſon having about him a certain number of Portugal pieces, ſaid, If the third, fourth, and ſixth of them were added together, they would make 54—I deſire to know how many he had? *Anſ.* 72.

3. A gentleman bought a chaiſe, horſe, and harneſs, for 60*l.* the horſe came to twice the price of the harneſs, and the chaiſe to twice the price of the horſe and harneſs—what did he give for each?

Anſ. horſe £13 : 6 : 8; *harneſs* £6 : 13 : 4; *chaiſe* £40.

4. A, B, and C, being determined to buy a quantity of goods, which would coſt them 120*l.* agreed among themſelves, that B ſhould have a third part more than A, and C a fourth part more than B;—I deſire to know what each man muſt pay. *Anſ.* A £30; B £40; C £50.

5. A man overtaking a maid driving a flock of geeſe, ſaid to her, How do you do, Sweetheart; where are you going with theſe 30 geeſe? No Sir, ſaid ſhe, I have not 30; but if I had as many more, half as may more, and 5 geeſe beſides, I ſhould have 30—how many had ſhe. *Anſ.* 10.

6. A perſon delivered to another a ſum of money unknown, to receive intereſt for the ſame at 6 *per cent. per annum*, ſimple intereſt, and at the end of ten years received for principal and intereſt 300*l.*—what was the ſum lent?

Anſ. £187 : 10*s.*

DOUBLE POSITION

Is by making uſe of two ſuppoſed numbers, and if both prove falſe, (as it generally happens, they are, with their errors, to be thus ordered.

Rule 1. Place each error againſt its reſpective poſition.

2. Multiply them croſs-wiſe.

3. If the errors are alike, *i. e.* both greater, or both leſs than the given number, take their difference for a diviſor, and the difference of their products for a dividend. But if unlike, take their ſum for a diviſor, and the ſum of their products for a dividend, the quotient will be the anſwer.

EXAMPLES.

1. A, B, and C, would divide 200*l.* between them, ſo that B may have 6*l.* more than A, and C 8*l*, more than B —how much muſt each have?

Suppoſe A *had*	40	*Then ſuppoſe* A *had*	50
then B —	46	*then* B *muſt have*	56
and C —	54	*and* C. —	64
	——		——
	140 *too little by* 60		170 *too little by* 30.

ſup. errors.

40 ✕	—60		
50 ✕	—30	60	60 A
——	——	30	66 B
3000	1200	—	74 C
1200		30 *diviſor.*	——
——			200 *proof.*
3|0) 180|0			
——			
60 *anſwer for* A.			

2. A man had two ſilver cups of unequal weight, having one cover to both of 5 oz.; now if the cover is put on the leſſer cup, it will be double the weight of the greater cup, and ſet on the greater cup, it will be thrice as heavy as the leſſer cup--what is the weight of each cup?

Anſ. 3 *ounces leſſer,* 4 *greater.*

3. A, B, and C playing at hazard together, the money ſtaked was 196 guineas; but diſagreeing, each ſeized as many as he could: A got a certain quantity; B as many as A, and 16 more; and C the 6th part of both their ſums-- how many had each? *Anſ.* A 76; B 92; *and* C 28.

4. A gentleman bought a houſe with a garden, and a horſe in the ſtable, for 500*l.* now he paid 4 times the price of the horſe for the garden, and 5 times the price of the garden for the houſe—what was the value of the houſe, garden, and horſe ſeparately?

Anſ. horſe £20; *garden* £80; *and houſe* £400.

5. Three perſons diſcourſed concerning their ages; ſays H, I am 30 years of age; ſays K, I am as old as H, and $\frac{1}{4}$ of L; and ſays L, I am as old as you both. What was the age of each perſon? *Anſ.* H 30; K 50; *and* L 80.

6. D, E, and F, playing at cards, ſtaked 324 crowns; but diſputing about the tricks, each man took as many as he could: D got a certain number; E as many as D, and 15 more; and F got a fifth part of both their ſums added together—how many did each get?

Anſ. D $127\frac{1}{2}$; E $142\frac{1}{2}$; *and* F 54.

7. A, ſtealing apples, was taken by B, and to appeaſe him gave him half of what he had, and B gives him back 10; going farther he meets C, who took from him half of what he had left, and gives him back 4; after that meeting with D, he gives him half of what he had, and he returns him back 1. At laſt getting ſafe away, he finds he had 13 left—how many had he at firſt? *Anſ.* 60.

8. A gentleman going into a garden, meets with ſome ladies, and ſays to them, Good morning to you, 10 fair maids. Sir, you miſtake, anſwered one of them, we are not 10; but if we were twice as many more as we are, we ſhould be as many above 10 as we are now under—how many were they? *Anſ.* 5.

EXCHANGE

IS the receiving money in one country for the ſame value paid in another.

The *par* of exchange is always fixed and certain, it being the intrinſic value of foreign-money, compared with ſterling; but the courſe of exchange riſes and falls, upon various occaſions.

I. FRANCE.

They keep their accounts at Paris, Lyons, and Rouen, in livres, ſols, and deniers, and exchange by the crown, = 4*s*. 6*d*. at *par*.

NOTE. 12 *deniers make* 1 *ſol*.
20 *ſols* —— 1 *livre*.
3 *livres* —— 1 *crown*.

To change French into Sterling.

RULE. As one crown is to the given rate, ſo is the French ſum to the ſterling required.

To change Sterling into French.

Rule. As the rate of exchange is to 1 crown, ſo is the ſterling ſum to the French required.

Examples.

1. How many crowns muſt be paid at Paris, to receive in London 180*l.* exchange, at 4*s.* 6*d.* *per* crown?

```
   d.  cr.  £.
As 54 : 1 :: 180 :
             240
        ——————— crowns
     54)43200(800
        432
        ———
        ...
        ———
```

2. A merchant at Paris remits to his correſpondent in London 800 crowns, at 4*s.* 6*d.* each; what is the value in ſterling?

```
   cr. d.   cr.
As 1 : 54 :: 800 :
              54
          ———————
       12)43200
          ———————
       2|0)360|0
          ———————
             180£
```

3. How much ſterling muſt be paid in London, to receive in Paris 758 crowns, exchange at 56*d.* *per* crown? *Anſ.* £176 : 17 : 4.

4. A merchant in London remits 176*l.* 17*s.* 4*d.* to his correſpondent at Paris—what is the value in French crowns, at 56*d.* *per* crown? *Anſ.* 758.

5. Change 725 crowns, 17 ſols, 7 deniers, at 54½*d.* *per* crown, into ſterling—what is the ſum? *Anſ.* £164 : 14*s.* 0½*d.*

6. Change 164*l.* 14*s.* 0½*d.* ſterling into French crowns, exchange at 54½*d.* *per* crown. *Anſ.* 725 *crowns,* 17 *ſols.* 7 *deniers.*

II. SPAIN.

They keep their accounts at Madrid, Cadiz, and Seville, in dollars, rials, and marvedies, and exchange by the piece of eight =4*s.* 6*d.* at *par.*

Note. 34 *marvedies make* 1 *rial.*
8 *rials* —— 1 *piaſtre, or piece of eight.*
10 *rials* —— 1 *dollar.*

Rule. As with France.

Examples.

7. A merchant at Cadiz remits to London 2547 pieces of eight, at 56*d.* *per* piece—how much ſterling is the ſum? *Anſ.* £594 : 6*s.*

8. How many pieces of eight, at 56*d.* each, will anſwer a bill of 594*l.* 6*s.* ſterling? *Anſ.* 2547.

9. If I pay a bill here of 2500*l.*—what Spaniſh money may I draw my bill for at Madrid, exchange at 57½*d. per* piece of eight? *Anſ.* 10434 *pieces of eight*, 6 *rials*, 8 *mar.*

III. ITALY.

They keep their accounts at Genoa and Leghorn in livres, ſols, and deniers, and exchange by the piece of eight, or dollar, = 4*s.* 6*d.* at *par.*

Note. 12 *deniers make* 1 *ſol.*
20 *ſols* —— 1 *livre.*
5 *livres* —— 1 *piece of eight, at* Genoa.
6 *livres* —— 1 *piece of eight, at* Leghorn.

☞ The exchange at Florence is by ducatoons; the exchange at Venice by ducats.

Note. 6 *ſolidi make* 1 *groſs.*
24 *groſſes* —— 1 *ducat.*

Rule. The ſame as before.

10. How much ſterling money may a perſon receive in London, if he pays in Genoa 976 dollars, at 53*d. per* dollar? *Anſ.* £215 : 10 : 8.

11. A merchant remitted 215*l.* 10*s.* 8*d.* ſterling to Leghorn—how many dollars will he receive there, the exchange being at 53*d. per dollar*? *Anſ.* 976.

12. A factor hath ſold goods at Florence, for 250 ducatoons, at 54*d.* each—what is the value in pounds ſterling? *Anſ.* £56 : 5*s.*

13. A bill of 56*l.* 5*s.* is remitted to Florence to be paid in ducatoons, at 54*d.* each—how many will be received? *Anſ.* 250.

14. If 275 ducats, at 4*s.* 5*d.* each, be remitted from Venice to London—what is the value in pounds ſterling? *Anſ.* £60 : 14 : 7.

15. A gentleman travelling, would exchange 60*l.* 14*s.* 7*d.* ſterling for Venice ducats, at 4*s.* 5*d.* each—how many muſt he receive? *Anſ.* 275.

IV. PORTUGAL.

They keep their accounts at Oporto and Liſbon in *reas*, and exchange on the *milrea*, = 6*s.* 8½*d.* at *par.*

Note. 1000 *reas make* 1 *milrea.*

Rule. The ſame as with France.

EXAMPLES.

16. A gentleman being deſirous to remit to his correſpondent in London 2750 milreas, exchange at 6*s.* 5*d.* *per* milrea—how much ſterling will he be creditor for in London? *Anſ.* £882 : 5 : 10.

17. If a bill be drawn from London of 882*l.* 5*s.* 10*d.* ſterling—how many milreas, at 6*s.* 5*d.* each, is equal in value to the ſaid ſum? *Anſ.* 2750.

18. A merchant at Oporto remits to London 4366 milreas, and 183 reas, at 5*s.* 5$\frac{5}{8}$*d.* exchange, *per* milrea—how much ſterling muſt be paid in London for this remittance? *Anſ.* £1193 : 17 : 6$\frac{3}{4}$.

19. If I pay a bill at London of 1193*l.* 17*s.* 6$\frac{3}{4}$*d.*—what muſt I draw for on my correſpondent at Liſbon, exchange at 5*s.* 5$\frac{5}{8}$*d.* *per* milrea? *Anſ.* 4366 *milreas,* 183 *reas.*

V. HOLLAND, FLANDERS, *and* GERMANY.

They keep their accounts at Antwerp, Amſterdam, Bruſſels, Rotterdam, and Hamburgh; ſome in pounds, ſhillings, and pence, as in England: others in guilders, ſtivers, and pennings; and exchange with us on our pound at 33*s.* 4*d.* Flemiſh, at *par.*

NOTE. 8 *pennings* *make* 1 *groat.*
2 *groats,* or 16 *pennings* —— 1 *ſtiver.*
20 *ſtivers* —— 1 *guilder or florin.*

ALSO

12 *groats, or* 6 *ſtivers* *make* 1 *ſchelling.*
20 *ſchellings, or* 6 *guilders,* —— 1 *pound.*

To change Flemiſh *into* ſterling.

RULE. As the given rate is to one pound, ſo is the Flemiſh ſum to the ſterling required.

To change ſterling *into* Flemiſh.

RULE. As 1*l.* ſterling is to the given rate, ſo is the ſterling given to the Flemiſh ſought.

EXAMPLES.

20. Remitted from London to Amſterdam a bill of 754*l.* 10*s.* ſterling—how many pounds Flemiſh is the ſum, the exchange at 33*s.* 6*d.* Flemiſh *per* pound ſterling? *Anſ.* £1263 : 15 : 9 *Flemiſh.*

21. A merchant at Rotterdam remits 1263*l.* 15*s.* 9*d* Flemiſh, to be paid in London—how much ſterling money muſt he draw for, the exchange being at 33*s.* 6*d.* Flemiſh *per* pound ſterling? *Anſ.* £754 : 10*s.*

22. If I pay in London 852*l.* 12*s.* 6*d.* ſterling—how many guilders muſt I draw for at Amſterdam, exchange at 34 ſchellings, $4\frac{1}{2}$ groats Fleming *per* pound ſterling?

Anſ. 8792 *guilders,* 13 *ſtivers,* $14\frac{1}{2}$ *pennings.*

23. What muſt I draw for at London, if I pay at Amſterdam 8792 guilders, 13 ſtivers, $14\frac{1}{2}$ pennings, exchange at 34 ſchellings, $4\frac{1}{2}$ groats *per* pound ſterling?

Anſ. £852 : 12 : 6.

To convert bank *money into* current, *and the contrary.*

Note. The bank money is worth more than the current. The difference between the one and the other is called *agio*, and is generally from 3 to 6 *per cent.* in favour of the bank.

To change bank *into* current *money.*

Rule. As 100 guilders bank is to 100 with the agio added, ſo is the bank given to the current required.

To change current *money into* bank.

Rule. As 100 with the agio added, is to 100 bank, ſo is the current money given to the bank required.

24. Change 794 guilders, 15 ſtivers, current money, into bank florins, agio $4\frac{3}{8}$ *per cent.*

Anſ. 761 *guilders,* 8 *ſtivers,* 11 *pennings.*

25. Change 761 guilders, 9 ſtivers, bank, into current money, agio $4\frac{3}{8}$ *per cent.*

Anſ. 794 *guilders,* 15 *ſtivers,* 4 *pennings.*

VI. IRELAND.

26. A gentleman remits to Ireland 575*l.* 15*s.* ſterling—what will he receive there, the exchange being at 10 *per cent.*? *Anſ.* £633 : 6 : 6.

27. What muſt be paid in London for a remittance of 633*l.* 6*s.* 6*d.* Iriſh, exchange at 10 *per cent.*?

Anſ. £575 : 15*s.*

COMPARISON *of* WEIGHTS *and* MEASURES.

Examples.

1. If 50 Dutch pence be worth 65 French pence—how many Dutch pence are equal to 350 French pence?

Anſ. $269\frac{15}{65}$.

2. If 12 yards at London make 8 ells at Paris—how many ells at Paris will make 64 yards at London?

Anſ. $42\frac{8}{12}$.

3. If 30lb. at London make 28lb. at Amſterdam—how many lb. at London will be equal to 350lb. at Amſterdam? *Anſ.* 375.

4. If 95lb. Flemiſh make 106lb. Engliſh—how many lb. Engliſh are equal to 275lb. Flemiſh? *Anſ.* $289\frac{45}{95}$.

CONJOINED PROPORTION.

Is when the coin, weight, or meaſures of ſeveral countries are compared in the ſame queſtion; or it is linking together a variety of proportions.

When it is required to find how many of the firſt ſort of coin, weight, or meaſures mentioned in the queſtion, are equal to a given quantity of the laſt.

Rule. Place the numbers alternately, beginning at the left-hand, and let the laſt number ſtand on the left-hand; then multiply the firſt row continually for a dividend, and the ſecond for a diviſor.

Proof, by as many ſingle Rules of Three as the queſtion requires.

Examples.

1. If 20lb. at London make 23lb. at Antwerp, and 155 lb. at Antwerp make 180lb. at Leghorn—how many lb. at London are equal to 72lb. at Leghorn?

Left.	*Right.*	
20	23	$20 \times 155 \times 72 = 223200$
155	180	$23 \times 180 = 4140)223200(53\frac{378}{414}$
72		

2. If 12lb. at London make 10lb. at Amſterdam, and 100lb. at Amſterdam 120lb. at Thoulouſe—how many lb. at London are equal to 40lb. at Tholouſe? *Anſ.* 40.

3. If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells Engliſh—how many braces at Venice are equal to 16 ells Engliſh? *Anſ.* $25\frac{80}{624}$.

4. If 40lb. at London make 36lb. at Amſterdam, and 90lb. at Amſterdam make 116lb. at Dantzick—how many lb. at London are equal to 130lb. at Dantzick? *Anſ.* $112\frac{288}{4176}$.

When it is required to find how many of the laſt ſort of coin, weight, or meaſure, mentioned in the queſtion, is equal to a quantity of the firſt.

Rule. Place the numbers alternately, beginning at the left-hand, and let the laſt number ſtand on the right-hand; then multiply the firſt row for a diviſor, and the ſecond for a dividend.

Examples.

5. If 12 lb. at London make 10 lb. at Amſterdam, and 100 lb. at Amſterdam 120 lb at Thoulouſe—how many lb. at Thoulouſe are equal to 40 lb at London? *Anſ.* 40 lb.

6. If 40 lb. at London make 36 lb. at Amſterdam, and 90 lb. at Amſterdam 116 lb. at Dantzick—how many lb. at Dantzick are equal to 122 lb. at London? *Anſ.* $141\frac{1872}{3600}$.

PROGRESSION conſiſts of TWO PARTS:

ARITHMETICAL *and* GEOMETRICAL.

ARITHMETICAL PROGRESSION

Is when the rank of numbers increaſe or decreaſe regularly by the continual adding or ſubtracting of the equal numbers: As 1, 2, 3, 4, 5, 6, are in Arithmetical Progreſſion by the continual increaſing or adding of one; 11, 9, 7, 5, 3, 1, by the continual decreaſing or ſubtracting of two.

Note. When any even number of terms differ by Arithmetical Progreſſion, the ſum of the two extremes will be equal to the two middle numbers, or any two means equally diſtant from the extremes; as 2, 4, 6, 8, 10, 12, where 6+8, the two middle numbers, are =12+2, the two extremes, and =10+4 the two means, =14.

When the number of terms are odd, the double of the middle term will be equal to the two extremes, or of any two means equally diſtant from the middle term; as 1, 2, 3, 4, 5, where the double of 3=5+1=2+4=6.

In Arithmetical Progreſſion five things are to be obſerved, *viz.*

1. The firſt term; *better expreſſed thus,* F.
2. The laſt term, L.
3. The number of terms, N.
4. The equal difference, D.
5. The ſum of all the terms. S.

Any three of which being given, the other two may be found.

The

The firſt, ſecond, and third terms given, to find the fifth.

Rule. Multiply the ſum of the two extremes by half the number of terms, or multiply half the ſum of the two extremes by the whole number of terms, the product is the total of all the terms: *or thus,*

I. F, L, N, are given to find S.

$$\overline{F+L} \times \frac{N}{2} = S.$$

Examples.

1. How many ſtrokes does the hammer of a clock ſtrike in 12 hours? *Anſ.* 78.

12+1=13, *then* 13×6=78.

2. A man buys 17 yards of cloth, and gave for the firſt yard 2*s.* and for the laſt 10*s.*—what did the 17 yards amount to? *Anſ.* £5 : 2*s.*

3. If 100 eggs were placed in a right line, exactly a yard aſunder from one another, and the firſt a yard from a baſket, what length of ground does that man go who gathers up theſe 100 eggs ſingly, returning with every egg to the baſket to put it in? *Anſ.* 5 *miles,* 1300 *yards.*

The firſt, ſecond, and third terms given to find the fourth.

Rule. From the ſecond ſubtract the firſt, the remainder divided by the third leſs one, gives the fourth: *or thus,*

II. F, L, N, are given to find D.

$$\frac{L-F}{N-1}=D$$

Examples.

4. A man had eight ſons, the youngeſt was 4 years old, and the eldeſt 32, they increaſe in Arithmetical Progreſſion—what was the common difference of their ages? *Anſ.* 4.

$32-4=28$, *then* $28 \div \overline{8-1}=4$ *common difference.*

5. A man is to travel from London to a certain place in 12 days, and go about 3 miles the firſt day, increaſing every day by an equal exceſs, ſo that the laſt day's journey may be 58 miles—what is the daily increaſe, and how many miles diſtant is that place from London? *Anſ.* 5 *daily increaſe.*

Therefore, as 3 *miles is to the firſt day's journey,*
3+5= 8 *the ſecond day,*
8+5=13 *the third day,* &c.
The whole diſtance is 366 *miles, or thus,*
58+3=61, *then* 61×6=366.

The firſt, ſecond, and fourth terms given, to find the third.

RULE. From the ſecond ſubtract the firſt, the remainder divide by the fourth, and to the quotient add 1, gives the third: *or thus,*

III. F, L, D, are given to find N.

$$\frac{L-F}{D}+1=N$$

EXAMPLES.

6. A perſon travelling into the country, went 3 miles the firſt day, and increaſed every day by 5 miles, till at laſt he went 58 miles in one day—how many days did he travel? *Anſ.* 12.

$58-3=55$, *then* $55\div5=11+1=12$, *the number of days.*

7. A man being aſked how many ſons he had, ſaid, that the youngeſt was four years old, and the eldeſt 32, and that he increaſed one in his family every four years—how many had he? *Anſ.* 8.

The ſecond, third, and fourth terms given, to find the firſt,

RULE. Multiply the fourth by the third, made leſs by 1, the product ſubtracted from the ſecond gives the firſt: *or thus,*

IV. L, N, D, are given to find F.

$$L-D\times\overline{N-1}=F$$

EXAMPLES.

8. A man in 10 days went from London to a certain town in the country, every day's journey increaſing the former by 4, and the laſt he went was 46 miles—what was the firſt?

$4\times\overline{10-1}=36$, *then* $46-36=10$, *the firſt day's journey.*

9. A man takes out of his pocket, at 8 ſeveral times, ſo many different numbers of ſhillings, every one exceeding the former by 6, the laſt 46—what was the firſt? *Anſ.* 4.

The fourth, third, and fifth given, to find the firſt.

RULE. Divide the fifth by the third, and from the quotient ſubtract half the product of the fourth multiplied by the third, leſs 1, gives the firſt: *or thus,*

V. N, D, S, are given to find F.

$$\frac{S}{N}-\frac{D\times\overline{N-1}}{2}=F$$

EXAMPLES.

The firſt, ſecond, and third terms given, to find the fifth

RULE. Multiply the ſum of the two extremes by half the number of terms, or multiply half the ſum of the two extremes by the whole number of terms, the product is the total of all the terms: *or thus,*

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3. If 100 eggs were placed in a right line, exactly a yard aſunder from one another, and the firſt a yard from a baſket, what length of ground does that man go who gathers up theſe 100 eggs ſingly, returning with every egg to the baſket to put it in? *Anſ.* 5 *miles,* 1300 *yards.*

The firſt, ſecond, and third terms given to find the fourth.

RULE. From the ſecond ſubtract the firſt, the remainder divided by the third leſs one, gives the fourth: *or thus,*

II. F, L, N, are given to find D.

$$\frac{L-F}{N-1}=D$$

EXAMPLES.

4. A man had eight ſons, the youngeſt was 4 years old, and the eldeſt 32, they increaſe in Arithmetical Progreſſion—what was the common difference of their ages? *Anſ.* 4.

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Therefore, as 3 *miles is to the firſt day's journey,*

$3+5=8$ *the ſecond day,*

$8+5=13$ *the third day, &c.*

The whole diſtance is 366 *miles, or thus,*

$58+3=61$, *then* $61\times6=366$.

The firſt, ſecond, and fourth terms given, to find the third.

Rule. From the ſecond ſubtract the firſt, the remainder divide by the fourth, and to the quotient add 1, gives the third: *or thus,*

III. F, L, D, are given to find N.

$$\frac{L-F}{D}+1=N$$

Examples.

6. A perſon travelling into the country, went 3 miles the firſt day, and increaſed every day by 5 miles, till at laſt he went 58 miles in one day—how many days did he travel? *Anſ.* 12.

$58-3=55$, *then* $55\div5=11+1=12$, *the number of days.*

7. A man being aſked how many ſons he had, ſaid, that the youngeſt was four years old, and the eldeſt 32, and that he increaſed one in his family every four years—how many had he? *Anſ.* 8.

The ſecond, third, and fourth terms given, to find the firſt,

Rule. Multiply the fourth by the third, made leſs by 1, the product ſubtracted from the ſecond gives the firſt: *or thus,*

IV. L, N, D, are given to find F.

$$L-D\times\overline{N-1}=F$$

Examples.

8. A man in 10 days went from London to a certain town in the country, every day's journey increaſing the former by 4, and the laſt he went was 46 miles—what was the firſt?

$4\times\overline{10-1}=36$, *then* $46-36=10$, *the firſt day's journey.*

9. A man takes out of his pocket, at 8 ſeveral times, ſo many different numbers of ſhillings, every one exceeding the former by 6, the laſt 46—what was the firſt? *Anſ.* 4.

The fourth, third, and fifth given, to find the firſt.

Rule. Divide the fifth by the third, and from the quotient ſubtract half the product of the fourth multiplied by the third, leſs 1, gives the firſt: *or thus,*

V. N, D, S, are given to find F.

$$\frac{S}{N}-\frac{D\times\overline{N-1}}{2}=F$$

EXAMPLES.

10. A man is to receive 360*l*. at 12 ſeveral payments, each to exceed the former by 4*l*. and is willing to beſtow the firſt payment on any one who can tell him what it is—what will that perſon have for his pains? *Anſ.* £8.

$360 \div 12 = 30$, *then* $30 - \frac{4 \times \overline{12 - 1}}{2} = 8$ *the firſt payment.*

The firſt, third, and fourth given, to find the ſecond.

RULE. Subtract the fourth from the product of the third, multiplied by the fourth; that remainder, added to the firſt, gives the ſecond: *or thus,*

VI. F, N, D, are given to find L.

$ND - D + F = L$.

EXAMPLES.

11. What is the laſt number of an Arithmetical Progreſſion, beginning at 6, and containing by the increaſe of 8 to 20 places? *Anſ.* 158.

$\overline{20 \times 8} - 8 = 152$, *then* $152 + 6 = 158$, *the laſt number.*

GEOMETRICAL PROGRESSION.

IS the increaſing or decreaſing of any rank of numbers by ſome common ratio; that is, by the continual multiplication or diviſion of ſome equal number: as 2, 4, 8, 16, increaſe by the multiplier 2, and 16, 8, 4, 2, decreaſe by the diviſor 2.

NOTE. When any number of terms is continued in Geometrical Progreſſion, the product of the two extremes will be equal to any two means equally diſtant from the extremes: as 2, 4, 8, 16, 32, 64, where 64×2 are $= 4 \times 32$, and $3 \times 16 = 128$.

When the number of terms are odd, the middle term multiplied into itſelf will be equal to the two extremes, or any two means equally diſtant from the mean: as, 2, 4, 8, 16, 32, where $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$.

In Geometrical Progreſſion the ſame five things are to be obſerved as in Arithmetical, *viz.*

1. The firſt term.
2. The laſt term.
3. The number of terms.
4. The equal difference or ratio.
5. The ſum of all the terms.

NOTE. As the laſt term in a long ſeries of numbers is very tedious to come at, by continual multiplication; therefore, for the readier finding it out, there is a ſeries of numbers made uſe of in Arithmetical Proportion, called *indices*, beginning with an unit, whoſe common difference is one; whatever number of indices you make uſe of, ſet as many numbers (in ſuch Geometrical Proportion as is given in the queſtion) under them.

As 1, 2, 3, 4, 5, 6, *indices.*
2, 4, 8, 16, 32, 64, *numbers in Geometrical Proportion.*

But if the firſt term in Geometrical Proportion be different from the ratio, the indices muſt begin with a cypher.

As 0, 1, 2, 3, 4, 5, 6, *indices.*
1, 2, 4, 8, 16, 32, 64, *numbers in Geometrical Proportion.*

When the indices begin with a cypher, the ſum of the indices made choice of muſt always be one leſs than the number of terms given in the queſtion; for 1 in the indices is over the ſecond term, and two over the third, &c.

Add any two of the indices together, and that ſum will agree with the product of their reſpective terms.

As in the firſt table of indices 2 + 5 = 7
Geometrical Proportion 4 × 32 = 128
Then in the ſecond } 2 + 4 = 6
4 × 16 = 64

In any Geometrical Progreſſion proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

RULE. Find what figures of the indices added together, would give the exponent of the term wanted; then multiply the numbers ſtanding under ſuch exponent into each other, and it will give the term required.

☞ When the exponent 1 ſtands over the ſecond term, the number of exponents muſt be 1 leſs than the number of terms.

EXAMPLES.

1. A man agrees for 12 peaches, to pay only the price of the laſt, reckoning a farthing for the firſt, and a halfpenny for

the ſecond, &c. doubling the price to the laſt—what muſt he give for them? *Anſ.* £2 : 2 : 8.

16 = 4

0, 1, 2, 3, 4, *exponents.* 16 = 4

1, 2, 4, 8, 16, *No. of terms.*

256 = 8

8 = 3

For 4 + 4 + 3 = 11, *No. of terms leſs* 1,

4)2048 = 11, *No. of far.*

12)512

2|0)4|2 : 8

2 : 2 : 8

2. A country gentleman going to a fair to buy ſome oxen, meets with a perſon who had 23; he demanded the price of them, was anſwered 16*l.* a-head: the gentleman bids him 15*l.* a-head, and he would buy all: the other tells him it could not be taken; but if he would give what the laſt ox would come to at a farthing for the firſt and doubling it to the laſt, he ſhould have all—what was the price of the oxen? *Anſ.* £4369 : 1 : 4.

In any Geometrical Progreſſion, not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE. Proceed as in the laſt, only obſerve that every product muſt be divided by the firſt term.

EXAMPLES.

3. A ſum of money is to be divided amongſt 8 perſons, the firſt to have 20*l.* the ſecond 60*l.* and ſo on in triple proportion—what will the laſt have? *Anſ.* £43740.

0, 1, 2, 3, $\frac{540 \times 450}{20} = 14580$ *then* $\frac{14580 \times 60}{20} = 43740$

20, 60, 180, 540,

3 + 3 + 1 = 7, *one leſs than the number of terms.*

4. A gentleman dying left nine ſons, to whom, and to his executors, he bequeathed his eſtate in manner following: To his executors 50*l.*; his youngeſt ſon was to have as much more as the executors, and each ſon to exceed the next younger by as much more—what was the eldeſt ſon's portion? *Anſ.* £25600.

The firſt term, ratio, and number of terms given, to find the ſum of all the terms.

RULE. Find the laſt term as before, then ſubtract the firſt from it, and divide the remainder by the ratio, leſs one, to the quotient of which add the greater, gives the ſum required.

EXAMPLES.

5. A ſervant ſkilled in numbers agreed with a gentleman to ſerve him twelve months, provided he would give him a farthing for his firſt month's ſervice, a penny for the ſecond, and 4*d.* for the third, &c.—what did his wages amount to? *Anſ.* £5825 : 8 : 5$\frac{1}{4}$.

$$256 \times 255 = 65536, \textit{ then } 65536 \times 64 = 4194304.$$

0, 1, 2, 3, 4,
1, 4, 16, 64, 256,

$$\frac{4194304 - 1}{4 - 1} = 1398101, \textit{ then}$$

$4 + 4 + 3 = 11$, *No. of terms leſs* 1.

$$1398101 + 4194304 = 5592405 \textit{ farthings.}$$

6. A man bought a horſe, and by agreement was to give a farthing for the firſt nail, three for the ſecond, &c. there were four ſhoes, and in each ſhoe 8 nails—what was the worth of the horſe? *Anſ.* £965114681693 : 13 : 4.

7. A certain perſon married his daughter on New-Year's Day, and gave her huſband 1*s.* towards her portion, promiſing to double it on the firſt day of every month, for one year—what was her portion? *Anſ.* £204 : 15*s.*

8. A laceman, well verſed in numbers, agreed with a gentleman to ſell him 22 yards of rich gold brocade lace, for 2 pins the firſt yard, 6 pins the ſecond, &c. in triple proportion—I deſire to know what he ſold the lace for, if the pins were valued at 100 for a farthing; alſo what the laceman got or loſt by the ſale thereof, ſuppoſing the lace ſtood him 7*l.* *per* yard?

Anſ. The lace ſold for £326886 : 0 : 9.
Gain £326732 : 0 : 9.

PERMUTATION.

IS the changing or varying the order of things.

RULE. Multiply all the given terms one into another, and the laſt product will be the number of changes required.

EXAMPLES.

1. How many changes may be rung upon 12 bells; and how long would they be ringing but once over, ſuppoſing

10

the ſecond, &c. doubling the price to the laſt—what muſt he give for them? *Anſ.* £2 : 2 : 8.

0, 1, 2, 3, 4, *exponents.*
1, 2, 4, 8, 16, *No. of terms.*

$$\begin{array}{r} 16=4 \\ 16=4 \\ \hline 256=8 \\ 8=3 \\ \hline \end{array}$$

For 4+4+3=11, *No. of terms leſs* 1,

$$\begin{array}{r} 4)2048=11, \textit{ No. of far.} \\ \hline 12)512 \\ \hline 2|0)4|2 : 8 \\ \hline 2 : 2 : 8 \\ \hline\hline \end{array}$$

2. A country gentleman going to a fair to buy ſome oxen, meets with a perſon who had 23; he demanded the price of them, was anſwered 16*l.* a-head: the gentleman bids him 15*l.* a-head, and he would buy all: the other tells him it could not be taken; but if he would give what the laſt ox would come to at a farthing for the firſt and doubling it to the laſt, he ſhould have all—what was the price of the oxen? *Anſ.* £4369 : 1 : 4.

In any Geometrical Progreſſion, not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE. Proceed as in the laſt, only obſerve that every product muſt be divided by the firſt term.

EXAMPLES.

3. A ſum of money is to be divided amongſt 8 perſons, the firſt to have 20*l.* the ſecond 60*l.* and ſo on in triple proportion—what will the laſt have? *Anſ.* £43740.

0, 1, 2, 3,
20, 60, 180, 540,

$$\frac{540\times450}{20}=14580 \text{ then } \frac{14580\times60}{20}=43740$$

3+3+1=7, *one leſs than the number of terms.*

4. A gentleman dying left nine ſons, to whom, and to his executors, he bequeathed his eſtate in manner following: To his executors 50*l.*; his youngeſt ſon was to have as much more as the executors, and each ſon to exceed the next younger by as much more—what was the eldeſt ſon's portion? *Anſ.* £25600.

The firſt term, ratio, and number of terms given, to find the ſum of all the terms.

Rule. Find the laſt term as before, then ſubtract the firſt from it, and divide the remainder by the ratio, leſs one, to the quotient of which add the greater, gives the ſum required.

Examples.

5. A ſervant ſkilled in numbers agreed with a gentleman to ſerve him twelve months, provided he would give him a farthing for his firſt month's ſervice, a penny for the ſecond, and 4*d.* for the third, &c.—what did his wages amount to? *Anſ.* £5825 : 8 : 5¼.

$256 \times 255 = 65536$, *then* $65536 \times 64 = 4194304$.

0, 1, 2, 3, 4,
1, 4, 16, 64, 256,
$4 + 4 + 3 = 11$, *No. of terms leſs* 1.

$$\frac{4194304 - 1}{4 - 1} = 1398101, \textit{then}$$

$1398101 + 4194304 = 5592405$ *farthings.*

6. A man bought a horſe, and by agreement was to give a farthing for the firſt nail, three for the ſecond, &c. there were four ſhoes, and in each ſhoe 8 nails—what was the worth of the horſe? *Anſ.* £965114681693 : 13 : 4.

7. A certain perſon married his daughter on New-Year's Day, and gave her huſband 1*s.* towards her portion, promiſing to double it on the firſt day of every month, for one year—what was her portion? *Anſ.* £204 : 15*s.*

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Anſ. The lace ſold for £326886 : 0 : 9.
Gain £326732 : 0 : 9.

PERMUTATION.

Is the changing or varying the order of things.

Rule. Multiply all the given terms one into another, and the laſt product will be the number of changes required.

Examples.

1. How many changes may be rung upon 12 bells; and how long would they be ringing but once over, ſuppoſing

10 changes might be rung in a minute, and the year to contain 365 days 6 hours.

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$ *changes, which* $\div\ 10 = 479001600$ *minutes; and if reduced, is* $=$ 91 *years,* 3 *weeks,* 5 *days,* 6 *hours.*

2. A young ſcholar coming into town for the convenience of a good library, demands of a gentleman with whom he lodged, what his diet would coſt for a year; who told him 10*l*. but the ſcholar not being certain what time he would ſtay, aſked him what he muſt give him for ſo long as he ſhould place his family, conſiſting of 6 perſons (beſides himſelf) in different poſitions, every day at dinner. The gentleman thinking it would not be long, tells him 5*l*. to which the ſcholar agrees—what time did the ſcholar ſtay with the gentleman? *Anſ.* 5040 *days.*

PART II.

VULGAR FRACTIONS.

INTRODUCTION.

A FRACTION is a part or parts of the unit, and written with two figures, with a line between them, as $\frac{1}{4}$, $\frac{5}{8}$, $\frac{3}{8}$, &c.

The figure above the line is called the *numerator*, and the under one the *denominator*; which ſhews how many parts the unit is divided into; and the numerator ſhews how many of thoſe parts are meant by the fraction.

There are four ſorts of Vulgar Fractions; *proper, improper, compound,* and *mixed*; *viz.*

1. A PROPER FRACTION is when the numerator is leſs than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{7}{8}$, $\frac{9}{11}$, $\frac{101}{701}$, &c.

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as $\frac{5}{5}$, $\frac{8}{4}$, $\frac{12}{12}$, $\frac{187}{2}$, &c.

3. A COMPOUND FRACTION is the fraction of a fraction, and known by the word *of*, as $\frac{1}{2}$ *of* $\frac{2}{3}$ *of* $\frac{7}{9}$ *of* $\frac{8}{17}$ *of* $\frac{9}{15}$, &c.

4. A MIXED NUMBER OF FRACTION is compoſed of a whole number and fraction, as $8\frac{2}{7}$, $17\frac{1}{2}$, $8\frac{71}{97}$, &c.

REDUCTION *of* VULGAR FRACTIONS.

1. *To reduce Fractions to a common Denominator.*

RULE. 1. Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for a common denominator. Or,

2. Multiply the common denominator by the ſeveral given numerators ſeparately, and divide the product by their ſeveral denominators, the quotients will be the new numerators.

EXAMPLES.

1. Reduce $\frac{2}{4}$ and $\frac{4}{7}$ to a common denominator.

facit $\frac{14}{28}$, *and* $\frac{16}{28}$.

1st. num. *2d. num.*

$2 \times 7 = 14$ $4 \times 4 = 16$, *then* $4 \times 7 = 28$ *den.* $= \frac{14}{28}$, *and* $\frac{16}{28}$.

2. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$ to a common denominator.

facit $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$.

3. Reduce $\frac{7}{8}$, $\frac{4}{6}$, $\frac{9}{10}$, and $\frac{6}{7}$ to a common denominator.

facit $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{3024}{3360}$, $\frac{2880}{3360}$.

4. Reduce $\frac{6}{10}$, $\frac{2}{4}$, $\frac{1}{7}$, and $\frac{3}{6}$ to a common denominator.

facit $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$.

5. Reduce $\frac{4}{5}$, $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{1}{8}$ to a common denominator.

facit $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$.

6. Reduce $\frac{2}{6}$, $\frac{5}{9}$, $\frac{2}{8}$, and $\frac{3}{5}$ to a common denominator.

facit $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1296}{2160}$.

To reduce a vulgar fraction to its loweſt terms.

RULE. Find a common meaſure by dividing the lower term by the upper, and that diviſor by the remainder following, till nothing remain; the laſt diviſor is the common meaſure; then divide both parts of the fraction by the common meaſure, and the quotient will give the fraction required.

☞ *If the common meaſure happen to be* 1, *the fraction is already in its loweſt term; and when a fraction hath cyphers at the right-hand, it may be abbreviated by cutting them off; as,* $\frac{24|0}{141|0}$.

EXAMPLES.

7. Reduce $\frac{24}{32}$ to its loweſt terms.

$24)32(1$
24

com. meaſure $8)24(3$ *then* $8)\frac{24}{32}(=\frac{3}{4}$ *facit.*
24

8. Reduce $\frac{30}{125}$ to its loweſt terms. *facit* $\frac{6}{25}$.
9. Reduce $\frac{203}{684}$ to its loweſt terms. *facit* $\frac{52}{171}$.
10. Reduce $\frac{192}{576}$ to its loweſt terms. *facit* $\frac{1}{3}$.
11. Reduce $\frac{825}{960}$ to its loweſt terms. *facit* $\frac{55}{64}$.
12. Reduce $\frac{5184}{6912}$ to its loweſt terms. *facit* $\frac{3}{4}$.

3. To reduce a mixed number to an improper fraction.

RULE. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a new numerator, which place over the denominator.

☞ *To expreſs a whole number fraction-ways, ſet one for the denominator given.*

EXAMPLES.

13. Reduce $18\frac{3}{7}$ to an improper fraction. *facit* $\frac{129}{7}$.
$18\times7+3=129$ *new numerator.* *facit* $\frac{129}{7}$.
14. Reduce $56\frac{13}{22}$ to an improper fraction. *facit* $\frac{1245}{22}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction. *facit* $\frac{3848}{21}$.
16. Reduce $13\frac{4}{5}$ to an improper fraction. *facit* $\frac{69}{5}$.
17. Reduce $27\frac{2}{9}$ to an improper fraction. *facit* $\frac{245}{9}$.
18. Reduce $514\frac{5}{16}$ to an improper fraction. *facit* $\frac{8229}{16}$.

4. To reduce an improper fraction to its proper terms.

RULE. Divide the upper term by the lower.

EXAMPLES.

19. Reduce $\frac{129}{7}$ to its proper terms. *facit* $18\frac{3}{7}$.
$129\div7=18\frac{3}{7}$.
20. Reduce $\frac{1245}{22}$ to its proper terms. *facit* $56\frac{13}{22}$.
21. Reduce $\frac{3848}{21}$ to its proper terms. *facit* $183\frac{5}{21}$.
22. Reduce $\frac{69}{5}$ to its proper terms. *facit* $13\frac{4}{5}$.
23. Reduce $\frac{245}{9}$ to its proper terms. *facit* $27\frac{2}{9}$.
24. Reduce $\frac{8229}{16}$ to its proper terms. *facit* $514\frac{5}{16}$.

5. *To reduce a compound fraction to a ſingle one.*

Rule. Multipty all the numerators for a new numerator and all the denominators for a new denominator.

Reduce the new fraction to its loweſt terms, by Rule 2.

Examples.

25. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a ſingle fraction.

facit $\begin{array}{l} 2\times3\times5=30 \\ 3\times5\times8=120 \end{array}$ *reduced to the loweſt term* $=\frac{1}{4}$.

26. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a ſingle fraction.

facit $\frac{220}{756}=\frac{55}{189}$.

27. Reduce $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{29}$ to a ſingle fraction.

facit $\frac{3003}{4872}=\frac{143}{232}$.

28. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a ſingle fraction.

facit $\frac{135}{240}=\frac{9}{16}$.

29. Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a ſingle fraction.

facit $\frac{168}{360}=\frac{7}{15}$.

30. Reduce $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{8}{10}$ to a ſingle fraction.

facit $\frac{80}{630}=\frac{8}{63}$.

6. *To reduce fractions of one denomination to the fraction of another,* but greater, *retaining the ſame value.*

Rule. Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to; then reduce that compound fraction to a ſingle one.

Examples.

31. Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.

facit $\frac{7}{8}$ of $\frac{1}{12}$ of $\frac{1}{20}=\frac{7}{1920}$.

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

facit $\frac{1}{960}$.

33. Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. Troy.

facit $\frac{4}{1200}$.

34. Reduce $\frac{4}{7}$ of a lb. Avoirdupoiſe to the fraction of an cwt.

facit $\frac{4}{784}$.

7. *To reduce fractions of one denomination to the fraction of another,* but leſs, *retaining the ſame value.*

Rule. Multiply the numerator by the parts contained in the ſeveral denominations between it, and that you would reduce it to, for a new numerator, and place it over the given denominator.

Reduce the new fraction to its loweſt terms.

EXAMPLES.

35. Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny. *facit* $\frac{7}{8}$.

$7\times20\times12=1680$ $\frac{1680}{1920}$ *reduced to its loweſt term*$=\frac{7}{8}$.

36. Reduce $\frac{1}{960}$ of a pound to the fraction of a penny. *facit* $\frac{1}{4}$.

37. Reduce $\frac{4}{1200}$ of a lb. Troy to the fraction of a pennyweight. *facit* $\frac{4}{5}$.

38. Reduce $\frac{4}{784}$ of an cwt. to the fraction of a lb. *facit* $\frac{4}{7}$.

8. *To reduce fractions of one denomination to another of the ſame value, having the numerator given of the required fraction.*

RULE. As the numerator of the given fraction is to its denominator, ſo is the numerator of the intended fraction to its denominator.

EXAMPLES.

39. Reduce $\frac{2}{3}$ to a fraction of the ſame value, whoſe numerator ſhall be 12. *As* 2 : 3 :: 12 : 18. *facit* $\frac{12}{18}$.

40. Reduce $\frac{5}{7}$ to a fraction of the ſame value, whoſe numerator ſhall be 25. *facit* $\frac{25}{35}$.

41. Reduce $\frac{5}{7}$ to a fraction of the ſame value, whoſe numerator ſhall be 47.

facit $\frac{47}{65\frac{4}{5}}$.

9. *To reduce fractions of one denomination to another of the ſame value, having the denominator given of the fraction required.*

RULE. As the denominator of the given fraction is to its numerator, ſo is the denominator of the intended fraction to its numerator.

EXAMPLES.

42. Reduce $\frac{2}{3}$ to a fraction of the ſame value, whoſe denominator ſhall be 18. *As* 3 : 2 :: 18 : 12. *facit* $\frac{12}{18}$.

43. Reduce $\frac{5}{7}$ to a fraction of the ſame value, whoſe denominator ſhall be 35. *facit* $\frac{25}{35}$.

44. Reduce $\frac{5}{7}$ to a fraction of the ſame value, whoſe denominator ſhall be $65\frac{4}{5}$.

facit $\frac{47}{65\frac{4}{5}}$.

10. *To reduce a mixed fraction to a ſingle one.*

Rule. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denominator.

Examples.

45. Reduce $\frac{36\frac{2}{3}}{48}$ to a ſimple fraction. *facit* $\frac{110}{144}=\frac{55}{72}$.

$36\times3+2=110$ *numerator.*
$48\times3 \quad =144$ *denominator.*

46. Reduce $\frac{23\frac{5}{7}}{38}$ to a ſimple fraction. *facit* $\frac{166}{266}=\frac{83}{133}$.

When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator: then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator.

Examples.

47. Reduce $\frac{47}{65\frac{4}{5}}$ to a ſimple fraction. *facit* $\frac{235}{329}=\frac{5}{7}$.

48. Reduce $\frac{19}{44\frac{1}{3}}$ to a ſimple fraction. *facit* $\frac{57}{335}=\frac{3}{7}$.

11. *To find the proper quantity of a fraction in the known parts of an integer.*

Rule. Multiply the numerator by the common parts of the integer, and divide by the denominator.

Examples.

49. Reduce $\frac{3}{4}$ of a pound ſterling to its proper quantity.
$3\times20=60\div4=15$*s.* *facit* 15*s.*

50. Reduce $\frac{2}{5}$ of a ſhilling to its proper quantity.
facit 4*d.* $3\frac{1}{5}$ *qrs.*

51. Reduce $\frac{4}{7}$ of a lb. Avoirdupoiſe to its proper quantity.
facit 9 *oz.* $2\frac{2}{7}$ *dr.*

52. Reduce $\frac{7}{9}$ of an cwt. to its proper quantity.
facit 3 *qrs.* 3 *lb.* 1 *oz.* $12\frac{4}{9}$ *dr.*

53. Reduce $\frac{3}{5}$ of a lb. Troy to its proper quantity.
facit 7 *oz.* 4 *dwt.*

54. Reduce $\frac{5}{9}$ of an ell Engliſh to its proper quantity.
facit 2 *qrs.* $3\frac{1}{9}$ *nails.*

55. Reduce $\frac{4}{5}$ of a mile to its proper quantity.
facit 6 *furl.* 16 *poles.*

56. Reduce $\frac{5}{8}$ of an acre to its proper quantity.
facit 2 *roods,* 20 *poles.*

57. Reduce $\frac{6}{7}$ of an hogſhead of wine to its proper quantity.
facit 54 *gallons.*

58. Reduce $\frac{3}{9}$ of a barrel of beer to its proper quantity.
facit 12 *gallons.*

59. Reduce $\frac{5}{12}$ of a chaldron of coals to its proper quantity.
facit 15 *buſhels.*

60. Reduce $\frac{3}{5}$ of a month to its proper time.
facit 2 *weeks,* 2 *days,* $19\frac{1}{5}$ *hours.*

12. *To reduce any given quantity to the fraction of any greater denomination, retaining the ſame value.*

Rule. Reduce the given quantity to the loweſt term mentioned for a numerator, under which ſet the integral part (reduced to the ſame term) for a denominator, and it will give the fraction required.

Examples.

61. Reduce 15*s.* to the fraction of a pound ſterling.
facit $\frac{15}{20}=\frac{3}{4}$£.

62. Reduce 4*d.* $3\frac{1}{5}$ *qrs.* to the fraction of a ſhilling.
facit $\frac{2}{5}$.

63. Reduce 9 oz. $2\frac{2}{7}$ dr. to the fraction of a lb. Avoirdupoiſe.
facit $\frac{4}{7}$.

64. Reduce 3 qrs. 3 lb. 1 oz. $12\frac{4}{9}$ dr. to the fraction of an cwt.
facit $\frac{7}{9}$.

65. Reduce 7 oz. 4 dwt. to the fraction of a lb. Troy.
facit $\frac{3}{5}$.

66. Reduce 2 qrs. $3\frac{1}{9}$ nails, to the fraction of an Engliſh ell.
facit $\frac{5}{9}$.

67. Reduce 6 furlongs 16 poles to the fraction of a mile.
facit $\frac{4}{5}$.

68. Reduce 2 roods 20 poles to the fraction of an acre.
facit $\frac{5}{8}$.

69. Reduce 54 gallons to the fraction of a hogſhead of wine.
facit $\frac{6}{7}$.

70. Reduce 12 gallons to the fraction of a barrel of beer.
facit $\frac{1}{3}$.

71. Reduce 15 buſhels to the fraction of a chaldron of coals. *facit* $\frac{5}{12}$.

72. Reduce 2 weeks, 2 days, $19\frac{1}{5}$ hours, to the fraction of a month. *facit* $\frac{3}{5}$.

ADDITION *of* VULGAR FRACTIONS.

RULE.

REDUCE the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

EXAMPLES.

1. Add $\frac{2}{3}$ and $\frac{5}{7}$ together. *facit* $\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=1\frac{8}{21}$.
2. Add $\frac{3}{4}$, $\frac{2}{7}$, and $\frac{5}{6}$ together. *facit* $1\frac{146}{168}$.
3. Add $\frac{1}{5}$, $4\frac{1}{3}$, and $\frac{2}{5}$ together. *facit* $4\frac{70}{75}$.
4. Add $7\frac{2}{3}$ and $\frac{2}{5}$ together. *facit* $8\frac{1}{15}$.
5. Add $\frac{2}{7}$, and $\frac{2}{7}$ of $\frac{7}{4}$ together. *facit* $\frac{11}{14}$.
6. Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. *facit* $17\frac{1}{24}$.

2. When the fractions are of ſeveral denominations, reduce them to their proper quantities and add as before.

7. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a ſhilling. *facit* 15*s*. 10*d*.
8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. *facit* 13*s*. $4\frac{1}{2}$*d*.
9. Add $\frac{3}{4}$ of a pound Troy to $\frac{1}{6}$ of an ounce. *facit* 9 *oz*. 3 *dwt*. 8 *gr*.
10. Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a lb. *facit* 16 *cwt*. 13 *oz*. $5\frac{1}{3}$ *dr*.
11. Add $\frac{2}{3}$ of a chaldron to $\frac{3}{4}$ of a buſhel. *facit* 24 *buſh*. 3 *pecks*.
12. Add $\frac{1}{6}$ of a yard to $\frac{2}{3}$ of an inch. *facit* 6 *inch*. 2 *bar*. c.

SUBTRACTION *of* VULGAR FRACTIONS.

RULE.

REDUCE the given fractions to a common denominator, then ſubtract the leſs numerator from the greater, and place the remainder over the common denominator.

2. When the lower fraction is greater than the upper, ſubtract the numerator of the lower fractions from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

EXAMPLES.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{5}{7}$.

$3\times7=21.5\times4=20.21-20=1$ *num.*.$4\times7=28$ *den.* $=\frac{1}{28}$.

2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. *facit* $\frac{11}{24}$.
3. From $5\frac{2}{3}$ take $\frac{9}{10}$. *facit* $4\frac{23}{30}$.
4. From $\frac{38}{47}$ take $\frac{3}{5}$. *facit* $\frac{49}{235}$.
5. From $\frac{19}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$. *facit* $\frac{359}{420}$.
6. From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$. *facit* $63\frac{3}{4}$.

3. When the fractions are of ſeveral denominations reduce them to their proper quantities, and ſubtract as before.

7. From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a ſhilling. *facit* 14*s.* 3*d.*
8. From $\frac{2}{3}$ of a ſhilling take $\frac{1}{2}$ of a penny. *facit* $7\frac{1}{2}$*d.*
9. From $\frac{3}{4}$ of a lb. Troy take $\frac{1}{6}$ of an ounce.
facit 8 *oz.* 16 *dwts.* 16 *gr.*
10. From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb.
facit 15 *cwt.* 3 *qrs.* 27 *lb.* 2 *oz.* $10\frac{2}{3}$ *dr.*
11. From $\frac{2}{3}$ of a chaldron take $\frac{3}{4}$ of a buſhel.
facit 23 *buſh.* 1 *pk.*
12. From $\frac{1}{6}$ of a yard take $\frac{2}{3}$ of an inch. *facit* 5 *in.* 1 *b. c.*

MULTIPLICATION *of* VULGAR FRACTIONS.

RULE.

PREPARE the given numbers (if they require it) by the rules of Reduction; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

☞ *When any number, either whole or mixed, is multiplied by a fraction, the product will be always leſs than the multiplicand, in the ſame proportion as the multiplying fraction is leſs than the unit.*

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{3}{5}$. *facit* $3\times3=9$ *num.*.$4\times5=20$ *den.* $=\frac{9}{20}$.
2. Multiply $\frac{7}{9}$ by $\frac{2}{3}$. *facit* $\frac{14}{27}$.
3. Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. *facit* $672\frac{9}{30}$.
4. Multiply $430\frac{6}{10}$ by $18\frac{3}{7}$. *facit* $7935\frac{24}{70}$.
5. Multiply $\frac{16}{21}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$. *facit* $\frac{96}{294}=\frac{16}{49}$.
6. Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *facit* $\frac{3}{8}$.
7. Multiply $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{3}$. *facit* $\frac{1}{9}$.
8. Multiply $\frac{1}{4}$ of $\frac{3}{8}$ by $\frac{5}{7}$. *facit* $\frac{15}{224}$.
9. Multiply $5\frac{6}{7}$ by $\frac{5}{6}$. *facit* $\frac{37}{42}$.

10. Multiply 24 by $\frac{2}{3}$. *facit* 16.
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. *facit* $5\frac{29}{32}$.
12. Multiply $9\frac{1}{2}$ by $\frac{2}{6}$. *facit* $3\frac{1}{6}$.

DIVISION *of* VULGAR FRACTIONS.

RULE.

PREPARE the given numbers (if they require it) by the rules of Reduction, then multiply the denominator of the diviſor into the numerator of the dividend for a new numerator, and the numerator of the diviſor into the denominator of the dividend for a new denominator.

☞ *When any whole number is divided by a fraction leſs than unity, the quotient will be greater than the dividend: but if any fraction be divided by a whole number greater than unity, the quotient will be leſs than the dividend.*

EXAMPLES.

1. Divide $\frac{9}{20}$ by $\frac{3}{5}$. $5 \times 9 = 45$ *num.* $3 \times 20 = 60$ *den.* $\frac{45}{60} = \frac{3}{4}$.
2. Divide $\frac{14}{27}$ by $\frac{2}{3}$. *facit* $\frac{7}{9}$.
3. Divide $672\frac{9}{30}$ by $13\frac{5}{6}$. *facit* $48\frac{3}{5}$.
4. Divide $7935\frac{24}{70}$ by $18\frac{3}{7}$. *facit* $430\frac{3}{5}$.
5. Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. *facit* $\frac{9}{10}$.
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{3}{4}$. *facit* $19\frac{41}{45}$.
7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$. *facit* $\frac{24}{36} = \frac{2}{3}$.
8. Divide $9\frac{2}{12}$ by $\frac{1}{2}$ of 7. *facit* $2\frac{13}{21}$.
9. Divide $\frac{9}{16}$ by $4\frac{1}{2}$. *facit* $\frac{1}{8}$.
10. Divide 16 by 24. *facit* $\frac{2}{3}$.
11. Divide $5205\frac{2}{10}$ by $\frac{4}{5}$ of 91. *facit* $71\frac{1}{2}$.
12. Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. *facit* $\frac{1}{3}$.

The SINGLE RULE *of* THREE DIRECT *in* VULGAR FRACTIONS.

RULE.

REDUCE the numbers as before directed in Reduction, ſo that the firſt and third may be of the ſame name: multiply the numerator of the firſt fraction by the denominator of the ſecond and third, for a new denominator; then multiply the denominator of the firſt fraction by the numerator of the ſecond and third, for a new numerator; that fraction will be the anſwer to the queſtion, which reduce to its proper quantity.—Or, when the three terms are properly reduced, proceed as in the Rule of Three of whole Numbers.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard coſt $\frac{5}{8}$ of a £—what will $\frac{9}{10}$ of a yard come to at that rate? *Anſ.* $\frac{18}{24}=15$*s.*

$\frac{3}{4}$ *yd.* : $\frac{5}{8}$ £ :: $\frac{9}{10}$ *yd.* : $\frac{18}{24}$ £.

for $4\times5\times9=180$ *num.*
and $3\times8\times10=240$ *den.* *or* $\frac{5}{8}\times\frac{9}{10}=\frac{45}{80}$ $\frac{3}{4})\frac{45}{80}(\frac{15}{20}$.

2. If $\frac{5}{6}$ of a yard coſt $\frac{2}{3}$ of a £.—what will $\frac{11}{12}$ of a yard coſt? *Anſ.* 14*s.* 8*d.*

3. If $\frac{3}{4}$ of a yard of lawn coſt 7*s.* 3*d.*—what will $10\frac{1}{3}$ yards coſt? *Anſ.* £4 : 19 : $10\frac{1}{2}$, $\frac{2}{3}$.

4. If $\frac{7}{8}$lb. coſt $\frac{3}{4}$*s.*—how many pounds will $\frac{8}{9}$ of 1*s.* buy? *Anſ.* $1\frac{8}{216}$*lb.*

5. If $\frac{3}{5}$ ell of Holland coſt $\frac{1}{3}$*l.*—what will $12\frac{2}{3}$ ells coſt at that rate? *Anſ.* £7 : 0 : $8\frac{3}{4}$. $\frac{15}{27}$.

6. If $12\frac{1}{2}$ yards of cloth coſt 15*s.* 9*d.*—what will $48\frac{1}{4}$ yards coſt at the ſame rate? *Anſ.* £3 : 0 : $9\frac{1}{2}$. $\frac{16}{100}$.

7. If $\frac{9}{10}$ of an cwt. coſt 284*s.*—what will $7\frac{1}{2}$ cwt. coſt at the ſame rate? *Anſ.* £118 : 6 : 8.

8. If three yards of broad cloth coſt $2\frac{4}{5}$*l.*—what will $10\frac{2}{7}$ yards coſt? *Anſ.* £9 : 12*s.*

9. If $\frac{1}{4}$ of a yard coſt $\frac{2}{3}$ of a £.—what will $\frac{3}{5}$ of an ell Engliſh come to at the ſame rate? *Anſ.* £2.

10. If 1lb. of cochineal coſt 1*l.* 5*s.*—what will $36\frac{7}{10}$*lb*: come to? *Anſ.* £45 : 17 : 6.

11. If 1 yard of broad cloth coſt $15\frac{5}{8}$*s.*—what will 4 pieces coſt, each containing $27\frac{3}{7}$ yards? *Anſ.* £85 : 14 : $3\frac{1}{4}$: $\frac{40}{56}$.

12. Bought $3\frac{1}{2}$ pieces of ſilk, each containing $24\frac{3}{8}$ ells, at 6*s.* $0\frac{3}{4}$*d.* *per* ell—I deſire to know what the whole quantity coſt? *Anſ.* £25 : 17 : $2\frac{1}{4}$. $\frac{15}{16}$.

The SINGLE RULE *of* THREE INVERSÈ *in* VULGAR FRACTIONS.

EXAMPLES.

IF 48 men can build a wall in $24\frac{1}{4}$ days—how many men can do the ſame in 192 days? *Anſ.* $6\frac{48}{768}$ *men.*

2. If $25\frac{2}{7}$*s.* will pay for the carriage of an cwt. $145\frac{1}{4}$ miles—how far may $6\frac{1}{2}$ cwt. be carried for the ſame money? *Anſ.* $22\frac{9}{26}$ *miles.*

3. If $3\frac{1}{4}$ yards of cloth, that is $1\frac{1}{5}$ yard wide, be ſufficient to make a cloke—how much muſt I have of that ſort which is $\frac{4}{5}$ yard wide, to make another of the ſame bigneſs?

Anſ. $4\frac{7}{8}$ *yards.*

4. If 3 men can do a piece of work in $4\frac{1}{2}$ hours—in how many hours will ten men do the ſame work?

Anſ. $1\frac{7}{20}$ *hour.*

5. If a penny white loaf weigh 7 oz. when a buſhel of wheat coſt 5*s.* 6*d.*—what is the buſhel worth when the penny white loaf weighs but $2\frac{1}{2}$ oz.? *Anſ.* 15*s.* $4\frac{4}{5}$*d.*

6. What quantity of ſhalloon that is $\frac{3}{4}$ yard wide will line $7\frac{1}{2}$ yards of cloth that is $1\frac{1}{2}$ yard wide? *Anſ.* 15 *yards.*

The DOUBLE RULE *of* THREE *in* VULGAR FRACTIONS.

EXAMPLES.

IF a carrier receive, $2\frac{1}{10}$*l.* for the carriage of 3 cwt. 150 miles—how much ought he to receive for the carriage of 7 cwt. $3\frac{1}{2}$ qrs. 50 miles? *Anſ.* £1 : 16 : 9.

2. If 100*l.* in 12 months gain 6*l.* intereſt—what principal will gain $3\frac{3}{8}$*l.* in nine months? *Anſ.* 75.

3. If 9 ſtudents ſpend $10\frac{7}{9}$*l.* in 18 days—how much will 20 ſtudents ſpend in 30 days? *Anſ.* £39 : 18 : $4\frac{360}{1458}$.

4. A man and his wife having laboured one day, earned $4\frac{5}{8}$*s.*—how much muſt they have for $10\frac{1}{2}$ days, when their two ſons helped them? *Anſ.* £4 : 17 : $1\frac{1}{2}$.

5. If 50*l.* in 5 months, gain $2\frac{37}{144}$*l.*——what time will $13\frac{1}{3}$*l.* require to gain $1\frac{1}{12}$*l.* *Anſ.* 9 *months.*

6. If the carriage of 60 cwt. 20 miles coſt $14\frac{1}{2}$*l.* what weight can I have carried 30 miles for $5\frac{7}{16}$*l.*?

Anſ. 15 *cwt.*

PART III.

DECIMAL FRACTIONS.

NUMERATION.

IN decimal fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is ſuppoſed to be divided into ten equal parts, and thoſe parts into tenths, and ſo on without end.

So that the denominator of a decimal being always known to conſiſt of an unit with as many cyphers as the numerator has places, is therefore never ſet down; the parts being only diſtinguiſhed from the whole numbers by a comma prefixed; thus, ,5 which ſtands for $\frac{5}{10}$, 25 for $\frac{25}{100}$, ,123 for $\frac{123}{1000}$.

But the different value of figures appears plainer by the following table.

Whole numbers.							Decimal Parts.					
7	6	5	4	3	2	1	2	3	4	5	6	7
Millions.	C *Thouſands.*	X *Thouſands.*	*Thouſands.*	*Hundreds.*	*Tens.*	*Units.*	*Parts of Tens.*	*Parts of Hundreds.*	*Parts of Thouſands.*	*Parts of* X *Thouſands.*	*Parts of* C *Thouſands.*	*Parts of Millions.*

From which it plainly appears, that as whole numbers increaſe in a tenfold proportion to the left-hand, decimal parts decreaſe in a tenfold proportion to the right-hand: ſo that cyphers placed before decimal parts decreaſe their value by removing them farther from the comma, or unit's place thus, ,5 is 5 parts of 10, or $\frac{5}{10}$, ,05 is 5 parts of 100, or $\frac{5}{100}$; ,005 is 5 parts of 1000, or $\frac{5}{1000}$; ,0005 is 5 parts of 10000, or $\frac{5}{10000}$. But cyphers after decimal parts do not alter their value. For ,5, ,50, ,500, &c. are each but $\frac{5}{10}$ of the unit.

A FINITE DECIMAL is that which ends at a certain number of places; but an INFINITE is that which no where ends.

A RECURRING DECIMAL is that wherein one or more figures are continually repeated, as 2,75222.

And 52,275275275 is called a COMPOUND RECURRING DECIMAL.

NOTE, *A finite decimal may be conſidered as infinite, by making cyphers to recur; for they do not alter the value of the decimal.*

In all operations, if the reſult conſiſts of ſeveral nines, reject them, and make the next ſuperior place an unit more; thus for 26,25999 write 26,26.

In all circulating numbers, daſh the laſt figure; thus, *as in* $86,5466\cancel{6}$.

ADDITION *of* DECIMALS.

RULE.

IN ſetting down the propoſed numbers to be added, great care muſt be taken in placing every figure directly underneath thoſe of the ſame value, whether they be mixed numbers, or pure decimal parts; and to perform which there muſt be a due regard had to the commas, or ſeparating points, which ought always to ſtand in a direct line, one under another, and to the right hand of them carefully place the decimal parts, according to their reſpective values; then add them as in whole numbers.

EXAMPLES.

1. Add 72,5 + 32,071 + 2,1574 + 371,4 + 2,75. *f.* 480,8784
2. Add 30,07 + 2,0071 + 59,4 + 3207,1.
3. Add 3,5 + 47,25 + 927,01 + 2,0073 + 1,5.
4. Add 52,75 + 47,21 + 724 + 31,452 + ,3075.
5. Add 3275 + 27,514 + 1,005 + 725 + 7,32.
6. Add 27,5 + 52 + 3 2075 + ,5741 + 2720.

SUBTRACTION *of* DECIMALS.

RULE.

SUBTRACTION of Decimals differs but little from whole numbers, only in placing the numbers, which muſt be carefully obſerved, as in Addition.

EXAMPLES.

1. From ,2754 take ,2371
2. From 2,37 take 1,76
3. From 271 take 215,7
4. From 270,2 take 76,4075
5. From 571 take 54,72
6. From 625 take 76,91
7. From 23,415 take ,3742
8. From ,107 take ,0007

MULTIPLICATION *of* DECIMALS.

RULE.

PLACE the factors, and multiply them as in whole numbers, and from the product towards the right hand cut off as many places for decimals as there are in both factors together; but if there ſhould not be ſo many places in the product, ſupply the defect with cyphers to the left-hand.

EXAMPLES.

1. Multiply ,2365 by ,2435 *facit* ,05758775.
2. Mult. 2,071 by 2,27
3. Mult. 27,15 by 25,3
4. Mult. 79347 by 23,15
5. Mult. 17105 by ,3257
6. Mult. 17105 by ,0237
7. Mult. 27,35 by 7,70071
8. Mult. 5,721 by ,0075
9. Mult. 2,07 by ,007
10. Mult. 20,15 by ,2705
11. Mult. ,907 by ,0025

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the ſeparating point in the multiplicand ſo many places towards the right-hand as there are cyphers in the multiplier: thus, ,578 × 10=5,78 ,578×100=57,8. ,578×1000=578. ,578×10000=5780.

Contracted MULTIPLICATION *of* DECIMALS.

RULE.

PUT the unit's place of the multiplier under that place of the multiplicand that is intended to be kept in the product; then invert the order of all the other figures, *i. e.* write them all the contrary way; then in multiplying, begin at the figure in the multiplicand, which ſtands over the figure you are then multiplying with, and ſet down the firſt figure of each particular product directly one under the other, and have a due regard to the increaſe ariſing from the figures on the right-hand of that figure you begin to multiply at in the multiplicand.

☞ *That in multiplying the figure left out every time next the right-hand in the multiplicand, if the product be 5, or upwards to 15, carry 1; if 15, or upwards to 25, carry 2; and if 25, or upwards to 35, carry 3, &c.*

EXAMPLES.

12. Multiply 384,672158 by 36,8345, and let there be only four places of decimals in the product. *facit* 14169,2065.

Contracted way.	*Common way.*	
384,672158	384,672158	
5438,63	36,8345	
115401647	1923	360790
23080329	15386	88632
3077377	115401	6474
115402	3077377	264
15387	23080329	48
1923	115401647	4
14169,2065	14169,2066	038510

13. Multiply 3,141592 by 52,7438, and leave only 4 places of decimals. *facit* 165,6994.

14. Multiply 2,38645 by 8,2175, and leave only 4 places of decimals. *facit* 19,6107.

15. Multiply 375,13758 by 16,7324, and let there be only 1 place of decimals. *facit* 6276,9.

16. Multiply 375,13758 by 16,7324, and leave only 4 places of decimals. *facit* 6276,9520.

17. Multiply 395,3756 by ,75642, and let there be only 4 places of decimals. *facit* 299,0699.

DIVISION *of* DECIMALS.

THIS rule is alſo worked as in whole numbers: The only difficulty is in valuing the quotient, which is done by any of the following rules.

RULE. 1. The firſt figure in the quotient is always of the ſame value with that figure of the dividend, which anſwers or ſtands over the place of units in the diviſor.

2. The

2. The quotient muſt always have ſo many decimal places as the dividend has more than the diviſor.

NOTE. 1. *If the diviſor and dividend have both the ſame number of decimal parts, the quotient will be a whole number.*

2. *If the dividend hath not ſo many places of decimals as are in the diviſor, then ſo many cyphers muſt be annexed to the dividend as will make them equal, and the quotient will then be a whole number.*

3. *But if, when the diviſion is done, the quotient has not ſo many figures as it ſhould have places of decimals, then ſo many cyphers muſt be prefixed as there are places wanting.*

EXAMPLES.

1. Divide 8564,825 by 6,321. *facit* 1354,9.

2. Divide 48 by ,144.
3. Divide 217,75 by 65.
4. Divide 125 by ,1045.
5. Divide 709 by 2,574.
6. Divide 5,714 by 8275.
7. Divide 7382,54 by 6,4252.
8. Divide ,0851648 by 4323.
9. Divide 267,15975 by 1,25.
10. Divide 72,1564 by ,1347.
11. Divide 715 by ,3075.

When numbers are to be divided by 10, 100, 1000, 10000, &c. it is performed by placing the ſeparating point in the dividend, ſo many places towards the left-hand, as there are cyphers in the diviſor.

Thus, 5784 ÷ 10 = 578,4
5784 ÷ 100 = 57,84
5784 ÷ 1000 = 5,784.
5784 ÷ 10000 = ,5784.

Contracted DIVISION *of* DECIMALS.

RULE.

BY the firſt Rule find what is the value of the firſt figure in the quotient; then by knowing the firſt figure's denomination, the decimal places may be reduced to any number, by taking as many of the left-hand figures of the dividend as will anſwer them; and, in dividing, omit one figure of the diviſor at each following operation.

NOTE. *That in multiplying every figure left out in the diviſor, you muſt carry* 1, *if it be* 5, *or upwards to* 15; *if* 15, *or upwards to* 25, *carry* 2; *if* 25, *or upwards to* 35, *carry* 3, &c.

EXAMPLES.

12. Divide 721,17562 by 2,257432, and let there be only three places of decimals in the quotient.

```
            Contracted.             |            Common way.
2,257432)721,17562(319,467          | 2,257432)721,17562(319,467
 . . . . . . 6772296                |          6772296|
            ———————                 |          ———————|—
             439460 .               |           439460|2
             225743 .               |           225743|2
            ———————                 |          ———————|—
             213717 . .             |           213717|00
             203169 . .             |           203168|88
            ———————                 |          ———————|———
              10548 . . .           |            10548|120
               9030 . . .           |             9029|723
               ————                 |             ————|————
               1518 . . . .         |             1518|3920
               1354 . . . .         |             1354|4592
               ————                 |             ————|————
                164 . . . . .       |              163|93280
                158 . . . . .       |              158|02024
                ———                 |              ———|—————
                  6                 |                5|91256
                ===                 |              ===|=====
```

13. Divide 8,758615 by 5,2714167.
14. Divide 51717591 by 8,7586.
15. Divide 25,1367 by 217,35.
16. Divide 51,47542 by ,123415.
17. Divide 70,23 by 7,9863.
18. Divide 27,104 by 3,712.

REDUCTION *of* DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

RULE.

ADD cyphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

EXAMPLES.

1. Reduce $\frac{1}{4}$ - - - - to a decimal. 4)1,00(,25 *facit.*
2. Reduce $\frac{1}{2}$ - - - - to a decimal. *facit* ,5.
3. Reduce $\frac{3}{4}$ - - - - to a decimal. *facit* ,75.
4. Reduce $\frac{3}{8}$ - - - - to a decimal. *facit* ,375.
5. Reduce $\frac{5}{26}$ - - - to a decimal. *facit* ,1923076+
6. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. *facit* ,6043956+

Note, If the given parts are of ſeveral denominations, they may be reduced either by ſo many diſtinct operations, as there are different parts, or by firſt reducing them into their loweſt denomination, and then divide as before; or,

2dly, Bring the loweſt into decimals of the next ſuperior denomination, and on the left-hand of the decimal found, place the parts given of the next ſuperior denomination; ſo proceeding till you bring out the decimal parts of the higheſt integer required, by ſtill dividing the product by the next ſuperior denominator; or,

3dly, To reduce ſhillings, pence, and farthings. If the number of ſhillings be even, take half for the firſt place of decimals, and let the ſecond and third places be filled up with the farthings contained in the remaining pence and farthings, always remembering to add 1, when it is or exceeds 25. But if the number of ſhillings be odd, the ſecond place of decimals muſt be increaſed by 5. Next divide half the number of farthings in the pence and farthings (rejecting 24 or 6*d.* if there be 6*d.*) by 12; the quotient, written after the 3 places before found, will give the decimal required.

7. Reduce 5*s.* to the decimal of a £. *facit* ,25.
8. Reduce 9*s.* to the decimal of a £. *facit* ,45.
9. Reduce 16*s.* to the decimal of a £. *facit* ,8.
10. Reduce 8*s.* 4*d.* to the decimal of a £. *facit* ,416.
11. Reduce 16*s.* $7\frac{3}{4}$*d.* to the decimal of a £. *facit* ,8322916.

firſt.	*ſecond.*	*third.*	
16*s.* $7\frac{3}{4}$*d.*	4)3,00	2)16	$7\frac{3}{4}$
12			4
	12)7,75	,832	
199			32
4	2|0)16,64583		
960)799 ,8322916	,8322916		

12. Reduce 19*s.* $5\frac{1}{2}$*d.* to the decimal of a £.
facit ,972916.
13. Reduce 12 grains to the decimal of a lb. Troy.
facit ,002083.
14. Reduce 12 drams to the decimal of a lb. Averdupoiſe.
facit ,046875.
15. Reduce 2 qrs. 14lb. to the decimal of an cwt.
facit ,625.

16. Reduce 2 furlongs to the decimal of a league.
facit ,0833.

17. Reduce 2 quarts 1 pint to the decimal of a gallon.
facit ,625.

18. Reduce 4 gallons, 2 quarts of wine, to the decimal of a hogſhead. *facit* ,071428 +.

19. Reduce 2 gallons, 1 quart of beer, to the decimal of a barrel. *facit* ,0625.

20. Reduce 52 days to the decimal of a year.
facit ,142465 +.

To find the value of any Decimal Fraction, *in the known parts of an* integer.

Rule. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting of the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding till you have brought in the leaſt known parts of the integer.

Examples.

21. What is the value of ,8322916 of a £. *Anſ.* 16*s.* 7½*d.* +

20

16,6458320

12

7,7499840

4

½ ,9999360

22. What is the value of ,002084 of a lb. Troy?
Anſ. 12,00384 *grs.*

23. What is the value of ,046875 of a lb. Avoirdupoiſe?
Anſ. 12 *drams.*

24. What is the value of ,625 of a cwt.
Anſ. 2 *qrs.* 14 *lb.*

25. What is the value of ,625 of a gallon?
Anſ. 2 *quarts,* 1 *pint.*

26. What is the value of ,071428 of a hogſhead of wine? *Anſ.* 4 *gal.* 1 *quart,* ,999856.

27. What is the value of ,0625 of a barrel of beer?
Anſ. 2 *gallons,* 1 *quart.*

28. What is the value of ,142965 of a year?
Anſ. 51,999725 *days.*

Decimal TABLES of COIN, WEIGHT, and MEASURE

TABLE I.

ENGLISH COIN.
1 £ the Integer.

Sh.	*dec.*	*Sh.*	*dec.*
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	·3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

Pence.	*Decimals.*
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farths.	*Decimals.*
3	,003125
2	,0020833
1	,0010415

TABLE II.

ENG. COIN 1 *Sh.*
Long Meaſ. 1 *Foot*
the Integer.

Pence and *Inches.*	*Decimals.*
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farths.	*Decimals.*
3	,0625
2	,041666
1	.020833

TABLE III.

TROY WEIGHT
1 lb. the Integer.
Ounces the ſame as Pence in the laſt Table.

Penny weight.	*Decimals*
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Grains.	*Decimals.*
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 Oz. the Integer.
Penny weights the ſame as Shillings in the firſt Table

Grains.	*Decimals.*
12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.

AVOIRDUP. WT.
112 lb. the Integer.

Qrs.	*Decimals.*
3	,75
2	,5
1	.25

Pounds	*Decimals.*
14	,125
13	,116071
12	,107143
11	,098214
10	.089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces	*Decimals.*
8	,004464
7	,003906

6	,003348
5	,002790
4	,002232
3	,001674
2	,001116
1	,000558

¼ Oz.	*Decimals.*
3	,000418
2	,000279
1	,000139

TABLE V.

Avoirdup. Wt.

1 lb. the Integer.

Ounces.	*Decimals.*
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

Drams.	*Decimals.*
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI.

Liquid Meas.

1 tun the Integer.

Gallon.	*Decimals.*
100	,396825
90	,357141
80	,317460
70	,277777
60	,238095
50	,198412
40	,158730
30	,119047
20	,079365
10	,039682
9	,035714
8	,031746
7	,027777
6	,023809
5	,019841
4	,015873
3	,011904
2	,007936
1	,003968

Pints.	*Decimals.*
4	,001984
3	,001488
2	,000992
1	,000496

A Hogshead the Integer.

Gallons	*Decimals.*
30	,476190
20	,317460
10	,158730
9	,142857
8	,126984
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

Pints.	*Decimals.*
3	,005952
2	,003968
1	,001984

TABLE VII.

Measure.

Liquid. *Dry.*
1 *Gallon.* 1 *Quarter.*
Integer.

Pint.	*Dec.*	*Bush.*
4	,5	4
3	,375	3
2	,25	2
1	,125	1

Q. pt.	*Dec.*	*Pk.*
3	,09375	3
2	,0625	2
1	,03125	1

Decimals.	*Q. pks.*
,0234375	3
015625	2
,0078125	1

Decimals.	*Pints.*
005859	3
003906	2
001953	1

TABLE VIII.

Long Measure.

1 mile the Integer.

Yards.	*Decimals.*
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909

500	,284091
400	,227272
300	,170454
200	,113636
100	,056818
90	,051136
80	,045454
70	,039773
60	,034091
50	,028409
40	,022727
30	,017045
20	,011364
10	,005682
9	,005114
8	,004545
7	,003977
6	,003409
5	,002841
4	.002273
3	,001704
2	,001136
1	,000568

Feet.	*Decimals.*
2	,0003787
1	,0001894

Inches.	*Decimals.*
6	,0000947
3	,0000474
1	,0000158

TABLE IX.

TIME.

1 Year the Integer

Months the same as Pence in the second Table.

Days.	*Decimals.*
365	1,000000
300	,821918
200	,547945
100	,273973
90	,246575
80	,219178
70	,191781
60	,164383
50	,136986
40	,109589
30	,082192
20	,054794
10	,027397
9	,024657
8	.021918
7	019178
6	,016438
5	,013698
4	,010959
3	,008219
2	,005479
1	,002739

1 Day the Integer.

Hours.	*Decimals.*
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

Minut.	*Decimals.*
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001388
1	,000694

TABLE X.

CLOTH MEASURE

1 Yard the Integer.

Qrs. the same as Table 4.

Nails	*Decimals*
2	,125
1	,0625

TABLE XI.

LEAD WEIGHT.

A Fother the Integ.

Hund.	*Decimals.*
10	,512820
9	,461538
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

Qrs.	*Decimals.*
2	,025641
1	,012820

Pound.	*Decimals.*
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036630
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	.0004578

The RULE *of* THREE *in* DECIMALS.

EXAMPLES.

IF 26½ yards coſt 3*l.* 16*s.* 3*d.*—what will 32¼ yards come to? *Anſ.* £4 : 12 : 9½.

Yds. £. *Yds.*
26,5 : 3,8125 :: 32,25
32,25
26,5)122,953125(4,63974=£4 : 12 : 9½.

2. What will the pay of 540 men come to at 1*l.* 5*s.* 6*d.* *per* man? *Anſ.* £688 : 10*s.*

3. If 7¾ yards of cloth coſt 2*l.* 12*s.* 9*d.*—what will 140½ yards of the ſame coſt? *Anſ.* £47 : 16 : 3 : 2,4*qrs.*

4. If a cheſt of ſugar, weighing 7 cwt. 2 qrs. 14lb. coſt 36*l.* 12*s.* 9*d.*—what will 2 cwt. 1 qr. 21 lb. of the ſame coſt? *Anſ.* £11 : 14 : 2 : 3,5 *qrs.*

5. A grocer buys 24 ton, 12 cwt. 2 qrs. 14lb. 12 oz. of tobacco for 3678*l.* 6*s.* 4*d.*—what will 1 oz. come to? *Anſ.* 1*d.*

6. What will 326lb. 1 qr. of tobacco come to, when 1½lb. is ſold for 3*s.* 6*d.* *Anſ.* £38 : 1 : 3.

7. What is the worth of 19oz. 3 dwt. 5 gr. of gold, at 2*l.* 19*s.* *per* oz. *Anſ.* £56 : 10 : 5 : 2,99 *qrs.*

8. What is the worth of 827¾ yards of painting, at 10½*d.* *per* yard? *Anſ.* £36 : 4 : 3 : 1,5 *qrs.*

9. If I lent my friend 34*l.* for ⅝ of a year—how much ought he to lend me $\frac{5}{12}$ of a year to requite my kindneſs? *Anſ.* £51.

10. If ¾ of a yard of cloth, that is 2¼ yards broad, make a garment—how much that is ⅘ of a yard wide will make the ſame? *Anſ.* 2,109375 *yards.*

11. If 1 oz. of ſilver coſt 5*s.* 6*d.*—what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 grs.? *Anſ.* £6 : 3 : 9 : 2,2 *qrs.*

12. If 1 lb. of tobacco coſt 15*d.*—what coſt 3 hogſheads, weighing together 15 cwt. 1 qr. 19 lb.? *Anſ.* £107 : 18 : 9.

13. If 1 cwt. of currans coſt 2*l.* 9*s.* 6*d.*—what will 45 cwt. 3 qrs. 14lb. coſt at the ſame rate? *Anſ.* £113 : 10 : 9 : 3 *qrs.*

14. Bought 6 cheſts of ſugar, each 6 cwt. 3 qrs. at 2*l.* 16*s.* *per* cwt.—what do they come to? *Anſ.* £113 : 8*s.*

15. Bought a tankard for 10*l.* 12*s.* at the rate of 5*s.* 4*d.* *per* ounce—what was the weight? *Anſ.* 39 *oz.* 15 *dwts.*

16. Gave 187*l*. 3*s*. 3*d*. for 25 cwt. 3 qrs. 14 lb. of tobacco—at what rate did I buy it at *per* lb.? *Anſ.* 15½*d*.

17. Bought 29 lb. 4 oz. of coffee for 10*l*. 11*s*. 3*d*.—what is the value of 3 lb.? *Anſ.* £1 : 1 : 8.

18. If I gave 1*s*. 1*d*. for 3½ lb. of cheeſe—what will be the value of 1 cwt.? *Anſ.* £1 : 14 : 8.

EXTRACTION *of the* SQUARE ROOT.

EXTRACTING the Square Root is to find out ſuch a number as being multiplied in itſelf, the product will be equal to the given number.

RULE 1*ſt*. Point the given number, beginning at the unit's place, then to the hundreds, and ſo upon every ſecond figure throughout.

2*dly*, Seek the greateſt ſquare number in the firſt point towards the left-hand, placing the ſquare number under the firſt point, and the root thereof in the quotient; ſubtract the ſquare number from the firſt point, and to the remainder bring down the next point, and call that the *Reſolvend*.

3*dly*, Double the quotient, and place it for a diviſor on the left-hand of the reſolvend; ſeek how often the diviſor is contained in the reſolvend (preſerving always the unit's place) and put the anſwer in the quotient, and alſo on the right-hand ſide of the diviſor; then multiply by the figure laſt put in the quotient, and ſubtract the product from the reſolvend; bring down the next point to the remainder (if there be any more) and proceed as before.

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
SQUARES.	1.	4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

1. What is the ſquare root of 119025? *Anſ.* 345.

```
 .  .  .
119025(345
 9
 ----
 64(290
    256
    ----
   685)3425
       3425
       ====
```

2. What is the ſquare root of 106929? *Anſ.* 327.
3. What is the ſquare root of 2268741? *Anſ.* 1506,23+.
4. What is the ſquare root of 7596796? *Anſ* 2756,228+.
5. What is the ſquare root of 36372961? *Anſ.* 6031.
6. What is the ſquare root of 22071204? *Anſ.* 4698.

When the given number conſiſts of a whole number, and decimals together, make the number of decimals even, by adding cyphers to them; ſo that there may be a point fall on the unit's place of the whole number.

7. What is the ſquare root of 3271,4207? *Anſ.* 57,19+.
8. What is the ſquare root of 4795,25731? *Anſ.* 69,247+.
9. What is the ſquare root of 4,372594? *Anſ.* 2,091+.
10. What is the ſquare root of 2,2710957? *Anſ.* 1,50701+.
11. What is the ſquare root of ,00032754? *Anſ.* ,01809+.
12. What is the ſquare root of 1,270054? *Anſ.* 1,1269+.

To extract the Square Root *of a* VULGAR FRACTION.

RULE. Reduce the Fraction to its loweſt terms: then extract the ſquare root of the numerator for a new numerator, and the ſquare root of the denominator for a new denominator.

If the fraction be a ſurd (i. e.) *a number where a root can never be exactly found, reduce it to a decimal, and extract the root of it.*

EXAMPLES.

13. What is the ſquare root of $\frac{2304}{5184}$? *Anſ.* $\frac{2}{3}$.
14. What is the ſquare root of $\frac{2704}{4225}$? *Anſ.* $\frac{4}{5}$.
15. What is the ſquare root of $\frac{9216}{12544}$? *Anſ.* $\frac{6}{7}$.

SURDS.

16. What is the ſquare root of $\frac{275}{341}$? *Anſ.* ,89802+.
17. What is the ſquare root of $\frac{357}{477}$? *Anſ.* ,86602+.
18. What is the ſquare root of $\frac{478}{549}$? *Anſ.* ,93308+

To extract the ſquare root of a mixed number.

RULE. 1. Reduce the fractional part of the mixed number to its loweſt term, and then the mixed number to an improper fraction.

2. Extract the roots of the numerator and denominator for a new numerator, and denominator.

If the mixed number given be a ſurd, reduce the fractional part to a decimal, annex it to the whole number, and extract the ſquare root thereof.

EXAMPLES.

19. What is the ſquare root of $51\frac{21}{25}$? *Anſ.* $7\frac{1}{5}$.
20. What is the ſquare root of $27\frac{9}{16}$? *Anſ.* $5\frac{1}{4}$.
21. What is the ſquare root of $9\frac{43}{49}$? *Anſ.* $3\frac{1}{7}$.

SURDS.

22. What is the ſquare root of $85\frac{14}{15}$? *Anſ.* 9,27+.
23. What is the ſquare root of $8\frac{5}{7}$? *Anſ.* 2,9519+.
24. What is the ſquare root of $6\frac{2}{5}$? *Anſ.* 2,5298+.

The APPLICATION.

1. There is an army conſiſting of a certain number of men, who are placed rank and file (that is, in the form of a ſquare, each ſide having 576 men)—I deſire to know how many the whole ſquare contains? *Anſ* 331776.

2. A certain pavement is made exactly ſquare, each ſide of which contains 97 feet—I demand how many ſquare feet are contained therein. *Anſ.* 9409.

To find the mean proportional between any two given numbers.

RULE. The ſquare root of the product of the given numbers is the mean proportional ſought.

EXAMPLES.

27. What is the mean proportion between 3 and 12?
Anſ. $3 \times 12 = 36$ *then* $\surd 36 = 6$ *the mean proportional.*

28. What is the mean proportional between 4276 and 842? *Anſ.* 1897,4+.

To find the ſide of a ſquare equal in area to any given ſuperfices.

RULE. The ſquare root of the content of any given ſuperfices, is the ſquare equal ſought.

EXAMPLES.

29. If the content of a given circle be 160—what is the ſide of the ſquare? *Anſ.* 12,64911.

30. If the area of a circle is 750—what is the ſide of the ſquare equal? *Anſ.* 27,38612.

The area of a circle given to find the diameter.

RULE. As 355 : 452, or, as 1 : 1,273239 :: the area to the ſquare of the diameter :——or, multiply the ſquare root of the area, by 1,12837, and the product will be the diameter.

EXAMPLES.

31. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of graſs, and no more, ſuppoſing the cow and tail to be 5½ yards? *Anſ.* 6,136 *perches.*

The area of a circle given to find the periphery or circumference.

RURE. As 113 : 1420, or, as 1 : 12,56637 :: the area to the ſquare of the periphery:—or, multiply the ſquare root of the area by 3·5449, and the product is the circumference.

EXAMPLES.

32. When the area is 12—what is the circumference? *Anſ.* 12,2793.

33. When the area is 160—what is the periphery? *Anſ.* 44,839.

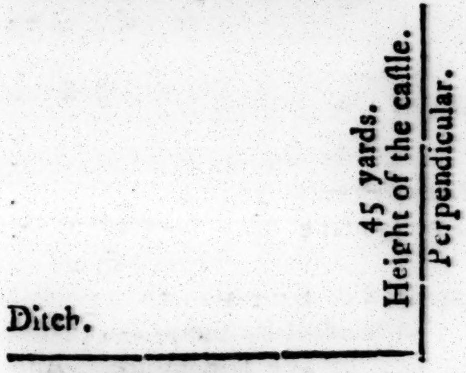
Any two ſides of a right-angled triangle given to find the third ſide.

1. *The baſe and perpendicular given to find the hypothenuſe.*

RULE. The ſquare root of the ſum of the ſquares of the baſe and perpendicular is the length of the hypothenuſe.

EXAMPLES.

34. The top of a caſtle from the ground is 45 yards high, and ſurrounded with a ditch 60 yards broad; what length muſt a ladder be to reach from the outſide of the ditch to the top of the caſtle? *Anſ.* 75 *yards.*



Baſe 60 yards.

35. The wall of a town is 25 feet high, which is ſurrounded by a moat of 30 feet in breadth—I deſire to know

the length of a ladder that will reach from the outſide of the moat to the top of the wall? *Anſ.* 39,05 *feet.*

2. *The hypothenuſe and perpendicular given to find the baſe.*

Rule. The ſquare root of the difference of the ſquares of the hypothenuſe and perpendicular is the length of the baſe.

3. *The baſe and hypothenuſe given to find the perpendicular.*

Rule. The ſquare root of the difference of the ſquares of the hypothenuſe and baſe is the height of the perpendicular.

☞ *The two laſt queſtions may be varied for examples to the two laſt propoſitions.*

Any number of men being given to form them into a ſquare battalia, or to find the number of rank and files.

Rule. The ſquare root of the number of men given, is the number of men either in rank or file.

36. An army conſiſting of 331776 men—I deſire to know how many rank and file? *Anſ.* 576.

37. A certain ſquare pavement contains 48841 ſquare ſtones all of the ſame ſize—I demand how many are contained in one of the ſides? *Anſ.* 221.

EXTRACTION *of the* CUBE ROOT.

To extract the cube root is to find out a number, which being multiplied into itſelf, and then into that product, produceth the given number.

Rule 1. Point every third figure of the cube given, beginning at the unit's place; ſeek the greateſt cube to the firſt point, and ſubtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a *reſolvend.*

2. Find a *diviſor,* by multiplying the ſquare of the quotient by 3. See how often it is contained in the reſolvend, rejecting the units and tens, and put the anſwer in the quotient.

3. To find the *ſubtrahend.* 1. Cube the laſt figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the laſt and that product by the ſquare of the laſt. 3. Multiply the diviſor by the laſt figure. Add theſe products together, gives the ſubtrahend, which ſubtract from the reſolvend; to the remainder bring down the next point and proceed as before.

Roots.

Roots.	1.	2.	3.	4.	5.	6.	7.	8.	9.
Cubes.	1.	8.	27.	64.	125.	216.	343	512.	729.

Examples.

1. What is the cube root of 99252847?

99252847(463
64=*cube of* 4
Diviſor.
Square of 4×3=48)35252 *reſolvend.*

216=*cube of* 6.
432 =4×3×*by ſquare of* 6.
288 =*diviſor* ×*by* 6.

33336 *ſubtrahend.*
Diviſor
Square of 46×3=6348)1916847 *reſolvend.*

27=*cube of* 3.
1242 =46×3×*by ſquare of* 3.
19044 =*diviſor* ×*by* 3.

1916847 *ſubtrahend.*

Another New *and more* Conciſe Method *of extracting the* CUBE ROOT.

Rule 1. Point every third figure of the cube given, beginning at the unit's place, then find the higheſt cube to the firſt point, and ſubtract it therefrom, put the root in the quotient, bring down the figures in the next point to the remainder for a reſolvend.

2. Square the quotient, and triple the ſquare for a diviſor. *As* 4×4×3=48. Find how often it is contained in the reſolvend, rejecting units and tens, and put the anſwer in the quotient.

3. Square the laſt figure in the quotient, and put it on the right hand of the diviſor.

As 6×6=36 put to the diviſor 48=4836.

4. Triple the laſt figure in the quotient, and multiply by the former, put it under the other, units under the tens, add them together, and multiply the ſum by the laſt figure in the

the quotient, ſubtract that product from the *reſolvend*, bring down the next point, and proceed as before.

EXAMPLES.

1. What is the cube root of 99252847? . . .

Square of 4×3=48 *diviſor.* 99252847(463
Square of 6 *put to* 48=4836 64
6×3×4=72
35252
5556×6= 33336
Square of 46=2116×3=6348 *diviſor.*
Square of 3=9 *put to* 6348=*634809 1916847
3×3×46=414
638949×3=1916847.

2. What is the cube root of 389017? *Anſ.* 73.
3. What is the cube root of 5735339? *Anſ.* 179.
4. What is the cube root of 32461759? *Anſ.* 319.
5. What is the cube root of 84604519? *Anſ.* 439.
6. What is the cube root of 259694072? *Anſ.* 638.
7. What is the cube root of 48228544? *Anſ.* 364.
8. What is the cube root of 27054036008? *Anſ.* 3002.
9. What is the cube root of 22069810125? *Anſ.* 2805.
10. What is the cube root of 122615327232? *Anſ.* 4968.
11. What is the cube root of 219365327791? *Anſ.* 6031.
12. What is the cube root of 673373097125? *Anſ.* 8765.

1. *When the given number conſiſts of a whole number, and decimal together, make the number of decimals conſiſt of* 3, 6, 9, *&c. places, by adding cyphers thereto, ſo that there may be a point fall in the unit's place of the whole number.*

13. What is the cube root of 12,977875? *Anſ.* 2,35.
14. What is the cube root of 36155,027576? *Anſ.* 33,06+.
15. What is the cube root of ,001906624? *Anſ.* ,124.
16. What is the cube root of 33,230979637? *Anſ.* 3,215+.
17. What is the cube root of 15926,972504? *Anſ.* 25,16+.
18. What is the cube root of ,053157376? *Anſ.* ,376.

To

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* When the quotient is 2 or 3, there muſt be a cypher put to ſupply the place of tens.

To extract the Cube Root of a Vulgar Fraction.

RULE. Reduce the fraction to its loweſt terms, then extract the cube root of its numerator and denominator, for a new numerator and denominator; but if the fraction be a ſurd, reduce it to a decimal, and then extract the root from it.

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Anſ.* $\frac{5}{7}$.
20. What is the cube root of $\frac{324}{1500}$? *Anſ.* $\frac{3}{5}$.
21. What is the cube root of $\frac{1520}{5130}$? *Anſ.* $\frac{2}{3}$.

SURDS.

22. What is the cube root of $\frac{4}{7}$? *Anſ.* ,829+.
23. What is the cube root of $\frac{5}{9}$? *Anſ.* ,822+.
24. What is the cube root of $\frac{2}{3}$? *Anſ.* ,873+.

To extract the Cube Root of a mixed number.

RULE. Reduce the fractional part to its loweſt terms, and then the mixed number to an improper fraction, extract the cube roots of the numerator and denominator for a new numerator and denominator; but if the mixed number given be a ſurd, reduce the fractional part to a decimal, annex it to the whole number, and extract the root therefrom.

EXAMPLES.

25. What is the cube root of $12\frac{19}{27}$? *Anſ.* $2\frac{1}{3}$.
26. What is the cube root of $31\frac{15}{343}$? *Anſ.* $3\frac{1}{7}$.
27. What is the cube root of $405\frac{28}{125}$? *Anſ.* $7\frac{2}{5}$.

SURDS.

28. What is the cube root of $7\frac{1}{5}$? *Anſ.* 1,93+.
29. What is the cube root of $9\frac{1}{6}$? *Anſ.* 2,092+.
30. What is the cube root of $8\frac{5}{7}$? *Anſ.* 2,057+.

The APPLICATION.

1. If a cubical piece of timber be of 47 inches long, 47 inches broad, and 47 inches deep—how many cubical inches doth it contain? *Anſ.* 103823.

2. There is a cellar dug, that is 12 feet every way, in length, breadth, and depth—how many ſolid feet of earth were taken out of it? *Anſ.* 1728.

3. There is a ſtone of a cubic form, which contains 389017 ſolid feet—what is the ſuperficial content of one of its ſides? *Anſ.* 5329.

Between two numbers given, to find two mean proportionals.

Rule. Divide the greater extreme by the leſs, and the cube root of the quotient multiplied by the leſs extreme gives the leſs mean; multiply the ſaid cube root by the leſs mean, and the product will be the greater mean proportional.

Examples.

4. What are the two mean proportionels between 6 and 162? *Anſ.* 18 *and* 54.

5. What are the two mean proportionals between 4 and 108? *Anſ.* 12 *and* 36.

To find the ſide of a cube that ſhall be equal in ſolidity to any given ſolid, as a globe, cylinder, priſm, cone, &c.

Rule. The cube root of the ſolid content of any ſolid body given, is the ſide of the cube of equal ſolidity.

Examples.

6. If the ſolid content of a globe is 10648—what is the ſide of a cube of equal ſolidity? *Anſ.* 22.

The ſide of the cube being given, to find the ſide of the cube that ſhall be double, treble, &c. in quantity to the cube given.

Rule. Cube the ſide given, and multiply it by 2, 3, &c. the cube root of the product is the ſide ſought.

Examples.

7. There is a cubical veſſel, whoſe ſide is 12 inches, and it is required to find the ſide of another veſſel, that is to contain 3 times as much? *Anſ.* 17,306.

EXTRACTING *of the* BIQUADRATE ROOT.

To extract the biquadrate root is to find out a number which being involved four times into itſelf will produce the given number.

Rule. Firſt extract the ſquare root of the given number, and then extract the ſquare root of that ſquare root, and it will give the biquadrate root required.

Examples.

1. What is the biquadrate of 27? *Anſ.* 531441.
2. What is the biquadrate of 76? *Anſ.* 33362176.
3. What is the biquadrate of 275? *Anſ.* 5719140625.
4. What is the biquadrate root of 531441? *Anſ.* 27.

5. What is the biquadrate root of 33362176? *Anſ.* 76.
6. What is the biquadrate root of 5719140625? *Anſ.* 275.

A general RULE *for* EXTRACTING *the* ROOTS *of all* POWERS.

1. PREPARE the number given for extraction, by pointing off from the unit's place as the root required directs.

2. Find the firſt figure in the root by the table of powers, which ſubtract from the given number.

3. Bring down the firſt figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the diviſor.

5. Find a quotient figure by common Diviſion, and annex it to the root; then involve the whole root into the given power, and call that the ſubtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the loweſt place, and to the remainder bring down the firſt figure of the next point for a new dividend.

7. Find a new diviſor, and proceed in all reſpects as before.

EXAMPLES.

1. What is the ſquare root of 141376?

· · ·
141376(376
9
—
6)51 *dividend.*
——
1369 *ſubtrahend.*
——
74)447 *dividend.*
——
141376 *ſubtrahend.*

3 × 2=6 *diviſor.*
37 × 37=1369 *ſubtrahend.*
37 × 2=74 *diviſor.*
376 × 376=141376 *ſubtrahend.*

2. What is the cube root of 53157376?

53157376(376
27

27)261 *dividend.*

50653 *ſubtrahend.*

4107)25043 *dividend.*

53157376 *ſubtrahend.*

3 × 3 × 3 = 27 *diviſor.*
37 × 37 × 37 = 50653 *ſubtrahend.*
37 × 37 × 3 = 4107 *diviſor.*
376 × 376 × 376 = 53157376 *ſubtrahend.*

3. What is the biquadrate root of 19987173376?

19987173376(376
81

108)1188 *dividend.*

1874161 *ſubtrahend.*
202612)1245563 *dividend.*

19987173376 *ſubtrahend.*

3 × 3 × 3 × 4=108 *diviſor.*
37 × 37 × 37 × 37=1874161 *ſubtrahend.*
37 × 37 × 37 × 4=202612 *diviſor.*
376 × 376 × 376 × 376=19987173376 *ſubtrahend.*

SIMPLE INTEREST.

THERE are five letters to be obſerved in Simple Intereſt, *viz.*

P. the principal.
T. the time.
R. the ratio, or *rate per cent.*
I. the intereſt.
A. the amount.

A TABLE of RATIOS.

3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

☞ *The* ratio *is the Simple Intereſt of* 1 *for one year, at the* rate per cent. *propoſed, and is found thus:*

As 100 : 3 :: 1 : ,03   *As* 100 : 3,5 :: 1 : ,035

When the principal, time, and rate per cent. *are given to find the intereſt.*

RULE. Multiply the principal, time, and rate together, and it will give the intereſt required.

NOTE. *The propoſition and rule are better expreſſed thus:*
I. *When* P, R, T, *are given to find* I.
RULE. *prt* = I.

☞ *When two or more letters are put together like a word, they are to be multiplied one into another.*

EXAMPLES.

1. What is the intereſt of 945*l.* 10*s.* for three years, at 5 *per cent. per annum?*
Anſ. £945,5 × ,05 × 3 = 141,825 or £141 : 16 : 6.

2. What is the intereſt of 547*l.* 14*s.* at 4 *per cent. per annum*, for 6 years? *Anſ.* £131 : 8 : 11. 2 *qr.* ,08.

3. What is the intereſt of 796*l.* 15*s.* at 4½ *per cent. per annum*, for 5 years? *Anſ.* £179 : 5 : 4. 2 *qr.*

4. What is the intereſt of 397*l.* 9*s.* 5*d.* for 2½ years, at 3½ *per cent. per annum?* *Anſ.* £34 : 15 : 6. 3,5499 *qr.*

5. What is the intereſt of 554*l.* 17*s.* 6*d.* for 3 years, 8 months, at 4½ *per cent. per ann.?* *Anſ.* £91 : 11*s.* 1—,20 *qr.*

6. What is the intereſt of 236*l.* 18*s.* 8*d.* for 3 years, 8 months, at 5½ *per cent. per annum?*
Anſ. £47 : 15 : 7. 2,2932 *qr.*

When the intereſt is for any number of days only.

RULE. Multiply the intereſt of 1*l.* for one day, at the given rate by the principal and number of days, it will give the anſwer.

INTEREST of 1*l.* for one DAY.

per cent.	*Decimals.*	*per cent.*	*Decimals.*
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958904	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

NOTE. *The above table is thus found:*
As 365:,03::1:,00008219178. *And as* 365:,035::1:,00009589041, *&c.*

EXAMPLES.

7. What is the intereſt of 240*l.* for 120 days, at 4 *per cent. per annum?* *Anſ.* 00010958904 × 240 × 120 = £3 : 3 : 1¼.

8. What is the intereſt of 563*l.* at 6 *per cent. per annum*, for 126 days? *Anſ* £11 : 13 : 2½.

9. What is the intereſt of 560*l.* for 60 days, at 5 *per cent. per annum?* *Anſ.* £4 : 12 : ½.

10. What is the intereſt of 364*l.* 18*s.* for 154 days, at 5 *per cent. per annum?* *Anſ.* £7 : 13 : 11¼.

11. What is the intereſt of 725*l.* 15*s.* for 74 days, at 4 *per cent. per annum?* *Anſ.* £5 : 17 : 8¼.

12. What is the intereſt of 100*l.* from the 1ſt of June, 1796, to the 9th of March following, at 5 *per cent. per annum?* *Anſ.* £3 : 16 : 11¾.

II. *When* P, R, T, *are given to find* A.

RULE. $prt+p=a$.

EXAMPLES.

13. What will 279*l.* 12*s.* amount to in 7 years, at 4½ *per cent. per annum?* *Anſ.* £367 : 13 : 5. 3,04 *qrs.*

279,6 × ,045 × 7 + 279,6 = 367,674.

14. What will 320*l.* 17*s.* amount to in 5 years, at 3½ *per cent. per annum?* *Anſ.* £367 : 19 : 11. 2,8 *qrs.*

15. What will 679*l.* 13*s.* amount to in 6 years, at 5 *per cent. per annum?* *Anſ.* £883 : 10 : 10. 3,2 *qrs.*

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to thoſe days.

16. What will 926*l*, 12*s*. amount to in $5\frac{1}{2}$ years, at 4 *per cent. per annum?* *Anſ.* £1130 : 9*s*. 1,92 *qrs*.

17. What will 368*l*. 16*s*. amount to in $7\frac{3}{4}$ years, at $6\frac{1}{2}$ *per cent. per annum?* *Anſ.* £554 : 11 : 7. 3,68 *qrs*.

18. What will 273*l*. 18*s*. amount to in 4 years, 175 days, at 3 *per cent. per annum?*

Anſ. £310 : 14 : 1. 3,35080064 *qrs*.

III. *When* A, R, T, *are given to find* P.

RULE. $\frac{a}{rt+1}=$P.

EXAMPLES.

19. What principal, being put to intereſt, will amount to 367*l*. 13*s*. 5*d*. 3,04 *qrs*. in 7 years, at $4\frac{1}{2}$ *per cent. per ann.?* *Anſ*. ,045 × 7 + 1 = 1,315, *then* 367,674 ÷ 1,315 = £279 : 12*s*

20. What principal, being put to intereſt, will amount to 376*l*. 19*s*. 11*d*. 2,8 *qrs*. in 5 years, at $3\frac{1}{2}$ *per cent. per annum?* *Anſ*. £320 : 17*s*.

21. What principal, being put to intereſt, will amount to 883*l*. 10*s*. 10*d*. 3,2 *qrs*. in 6 years, at 5 *per cent. per annum?* *Anſ.* £679 : 13*s*.

22. What principal, being put to intereſt, will amount to 1130*l*. 9*s*. 1,92 *qrs*. in $5\frac{1}{2}$ years, at 4 *per cent per annum?* *Anſ.* £926 : 12*s*.

23. What principal will amount to 554*l*. 11*s*. 7*d*. 3,68 *qrs*. in $7\frac{3}{4}$ years, at $6\frac{1}{2}$ *per cent. per annum?* *Anſ.* £368 : 16*s*.

24. What principal will amount to 310*l*. 14*s*. 1*d*. 3,35080064 *qrs*. in 4 years 175 days, at 3 *per cent. per annum?* *Anſ.* £273 : 18*s*.

IV. *When* A, P, T, *are given to find* R.

RULE. $\frac{a-p}{pt}=$R.

EXAMPLES.

25. At what rate *per cent.* will 279*l*. 12*s*. amount to 367*l*. 13*s*. 5*d*. 3,04 *qrs*. in 7 years?

Anſ. 367,674 − 279,6 = 88,074. 299,6 × 7 = 1957,2.
then 88,074 ÷ 1957,2 = ,045 *or* $4\frac{1}{2}$ *per cent.*

26. At what rate *per cent.* will 320*l*. 17*s*. amount to 376*l*. 19*s*. 11*d*. 2,8 *qrs*. in 5 years? *Anſ.* $3\frac{1}{2}$ *per cent.*

27. At what rate *per cent.* will 679*l*. 13*s*. amount to 883*l*. 10*s*. 10*d*. 3,2 *qrs*. in 6 years. *Anſ.* 5 *per cent.*

28. At what rate *per cent.* will 926*l.* 12*s.* amount to 1130*l.* 9*s.* 1,92 *qrs.* in $5\frac{1}{2}$ years? *Anſ.* 4 *per cent.*

29. At what rate *per cent.* will 368*l.* 16*s.* amount to 554*l.* 11*s.* 7*d.* 3,68 *qrs.* in $7\frac{3}{4}$ years? *Anſ.* $6\frac{1}{2}$ *per cent.*

30. At what rate *per cent.* will 273*l.* 18*s.* amount to 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.* in 4 years, 175 days? *Anſ.* 3 *per cent.*

V. *When* A, P, R, *are given to find* T.

RULE. $\frac{a-p}{pr.} = T.$

EXAMPLES.

31. In what time will 279*l.* 12*s.* amount to 367*l.* 13*s.* 5*d.* 3,04 *qrs.* at $4\frac{1}{2}$ *per cent.*? *Anſ.* 367,674—279,6=88074. 279,6×,045=12,5820, *then* 88,074÷12,5820=7 *years.*

32. In what time will 320*l.* 17*s.* amount to 376*l.* 19*s.* 11*d.* 2,8 *qrs.* at $3\frac{1}{2}$ *per cent.*? *Anſ.* 5 *years.*

33. In what time will 679*l.* 13*s.* amount to 883*l.* 10*s.* 10*d.* 3,2 *qrs.* at 5 *per cent.*? *Anſ.* 6 *years.*

34. In what time will 926*l.* 12*s.* amount to 1130*l.* 9*s.* 1,92 *qrs.* at 4 *per cent.*? *Anſ.* $5\frac{1}{2}$ *years.*

35. In what time will 368*l.* 16*s.* amount to 554*l.* 11*s.* 7*d.* 3,68 *qrs.* at $6\frac{1}{2}$ *per cent.*? *Anſ.* $7\frac{3}{4}$ *years.*

36. In what time will 273*l.* 18*s.* amount to 310*l.* 14*s.* 1*d.* 3,35080064 *qrs.* at 3 *per cent.*? *Anſ.* 4 *years.* 175 *days.*

ANNUITIES, *or* PENSIONS, &*c.* *in* ARREARS.

Annuities or penſions, &*c.* are ſaid to be in arrears, when they are payable or due, either yearly, half-yearly, or quarterly and are unpaid for any number of payments.

NOTE. U *repreſents the* annuity, penſion, *or* yearly rent, T, R, A, *as before.*

I. U, R, T, *are given to find* A.

RULE. $\frac{ttu-tu}{2} \times r : + tu = A.$

EXAMPLES.

37 If a salary of 150*l.* be forborne 5 years, at 5 *per cent.*—what would it amount to. *Anſ.* £85

$\overline{5\times5150} - \overline{5\times150} = 3000$ *then* $\frac{3000}{2}\times,05 + 5\times150 = 852$

38. If 250*l.* yearly penſion be forborne 7 years—what will it amount to in that time, at 6 *per cent.*? *Anſ.* £2065.

39. There is a houſe let upon a leaſe for $5\frac{1}{2}$ years, at 60*l.* *per annum*—what will be the amount of the whole time, at $4\frac{1}{2}$ *per cent.*? *Anſ.* £363 : 8 : 3.

40. Suppoſe an annual penſion of 28*l.* remain unpaid for 8 years—what would it amount to at 5 *per cent.*? *Anſ.* £263 : 4*s.*

Note. *When the annuities, &c. are to be paid half-yearly, or quarterly, then*

For half yearly payments, *take half of the ratio, half of the annuity,* &c. *and twice the number of years,—and*

For quarterly payments, *take a fourth part of the ratio, a fourth part of the annuity, &c. and four times the number of years, and work as before.*

EXAMPLES.

41. If a ſalary of 150*l.* payable every half-year, remains unpaid for 5 years—what would it amount to in that time, at 5 *per cent.*? *Anſ.* £834 : 7 : 6.

42. If a ſalary of 150*l.* payable every quarter, was left unpaid for 5 years—what would it amount to in that time, at 5 *per cent.*? *Anſ.* 839 : 1 : 3.

Note. *It may be obſerved, by comparing theſe laſt examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.*

II. *When* A, R, T, *are given to find* U.

RULE. $\frac{2a}{ttr-tr+2t}=U.$

EXAMPLES.

43. If a ſalary amounted to 825*l.* in 5 years, at 5 *per cent.*—what was the ſalary? *Anſ.* £150.

$825\times2=1650.$ $\overline{5\times5\times,05}-\overline{5\times,05}+\overline{5\times2}=11,$ *then* $1650\div11=150.$

44. If an houſe is to be let upon a leaſe for $5\frac{1}{2}$ years, and the amount for that time be 363*l.* 8*s.* 3*d.* at $4\frac{1}{2}$ *per cent.*—what is the yearly rent? *Anſ.* £60.

45. If a penſion amounted to 2065*l.* in 7 years, at 6 *per cent.*—what was the penſion? *Anſ.* £250.

46. Suppoſe the amount of a penſion be 263*l.* 4*s.* in 8 years, and at 5 *per cent.*—what is the penſion? *Anſ.* £28.

Note. *When the payments are half-yearly, then take* 4a, *half of the ratio, and twice the number of years; and if quarterly, then take* 8a, *one fourth of the ratio, and four times the number of years, and proceed as before.*

49. If the amount of a ſalary, payable half yearly, for 5 years, and at 5 *per cent.* be 834*l.* 7*s.* 6*d.*—what is the ſalary?
Anſ. £150.

48. If the amount of the annuity, payable quarterly, be 839*l.* 1*s.* 3*d.* for 5 years, at 5 *per cent.*—what is the annuity?
Anſ. £150.

III. *When* U, A, T, *are given to find* R.

Rule. $\frac{2a-2ut}{utt-ut}=R.$

EXAMPLES.

49. If a ſalary of 150*l. per annum*, amount to 825*l.* in 5 years—what is the rate *per cent.?* *Anſ.* 5 *per cent.*

$\overline{825\times2}-\overline{150\times5}\,\overline{\times5\times2}=150$ *then* $\frac{150}{150\times5\times5-150\times5}=,05$

50. If a houſe be let upon leaſe for $5\frac{1}{2}$ years, at 60*l. per annum*, and the amount for that time be 363*l.* 8*s.* 3*d.*—what is the rate *per cent.?* *Anſ.* $4\frac{1}{2}$ *per cent.*

51. If a penſion of 250*l. per annum* amounts to 2065*l.* in 7 years—what is the rate *per cent.?* *Anſ.* 6 *per cent.*

52. Suppoſe the amount of a yearly penſion of 28*l.* be 263*l.* 4*s.* in 8 years—what is the rate *per cent.?*
Anſ. 5 *per cent.*

Note. *When the payments are half-yearly, take* 4a—4ut *for a dividend, and work with half the annuity, and double the number of years for a diviſor; if quarterly, take* 8a—4ut *and work with a fourth of the annuity, and four times the number of years.*

53. If a ſalary of 150*l. per annum*, payable half-yearly, amounts to 834*l.* 7*s.* 6*d.* in 5 years—what is the rate *per cent.?* *Anſ.* 5 *per cent.*

54. If an annuity of 150*l. per annum*, payable quarterly, amounts to 839*l.* 1*s.* 3*d.* in 5 years—what is the rate *per cent.?* *Anſ.* 5 *per cent.*

IV. *When* U, A, R, *are given to find* T.

RULE. *Firſt*, $\frac{2}{r}-1=x$, *then* $\sqrt{\frac{2a}{ur}+\frac{xx}{4}}: -\frac{x}{2}=T.$

EXAMPLES.

55. In what time will a ſalary of 150*l*. *per annum* amount to 825*l*. at 5 *per cent.?* *Anſ.* 5 *years.*

$$\frac{2}{,05}-1=39\ \frac{825\times2}{150\times,05}=220\ \frac{39\times39}{4}=380,25.$$

$$\sqrt{220+380,23}=25,4\frac{39}{2}=5 \text{ years.}$$

56. If a houſe is let upon leaſe for a certain time for 60*l*. *per annum*, and the amount be 363*l*. 8*s*. 3*d*. at $4\frac{1}{2}$ *per cent.*—what time was it let for? *Anſ.* $5\frac{1}{2}$ *years.*

57. If a penſion of 250*l*. *per annum*, being forborne a certain time, amounts to 2065*l*. at 6 *per cent.*—what was the time of forbearance? *Anſ.* 7 *years.*

58. In what time will a yearly penſion of 28*l*. amount to 263*l*. 4*s*. at 5 *per cent.?* *Anſ.* 8 *years.*

NOTE. *If the payments are half-yearly, take half of the ratio and half the annuity; if quarterly, one fourth of the ratio, and one fourth of the annuity; and* T *will be equal to thoſe half-yearly or quarterly payments.*

59. If an annuity 150*l*. *per annum* payable half-yearly amounts to 834*l*. 7*s*. 6*d*. at 5 *per cent.*—what time was the payment forborne. *Anſ.* 5 *years.*

60. If a yearly penſion of 150*l*. payable quarterly, amounts to 839*l*. 1*s*. 3*d*. at 5 *per cent.*—what was the time of forbearance? *Anſ.* 5 *years.*

PRESENT WORTH *of* ANNUITIES.

Note. P *repreſents the preſent worth*; U, T, R, *as before.*

I. *When* U, T, R, *are given to find* P.

RULE. $\frac{ttr-tr+2t}{2tr+2}:\times u=P.$

EXAMPLES.

61. What is the preſent worth of 250*l. per annum*, to continue 5 years, at 5 *per cent.*? *Anſ.* £660.

$$\overline{5\times5\times{,}05}-\overline{5\times{,}05}+\overline{5\times2}=11.\quad \overline{5\times{,}05\times2}+2=2{,}5$$

then $11\div2{,}5\times150=$ £660

62. What is the yearly rent of a houſe of 60*l.* to continue $5\frac{1}{2}$ years, worth in ready money, at $4\frac{1}{2}$ *per cent.*? *Anſ.* £291 : 6 : 3.

63. What is the preſent worth of 250*l. per annum*, to continue 7 years, at 6 *per cent.*? *Anſ.* £1454 : 4 : 6.

64. What is a penſion of 28*l. per annum* worth in ready money, at 5 *per cent.* for 8 years? *Anſ.* £188.

☞ *The ſame thing is to be obſerved as in the firſt rule of annuities in arrear, concerning half-yearly and quarterly payments.*

65. What is the preſent worth of 150*l.* payable half-yearly, for 5 years, at 5 *per cent.*? *Anſ.* £667 : 10*s.*

66. What is the preſent worth of 150*l.* payable quarterly, for 5 years, at 5 *per cent.*? *Anſ.* 671 : 5*s.*

NOTE. *By comparing the laſt examples it will be ſound, that the preſent worth of half-yearly payment is more advantageous than yearly; and quarterly, than half-yearly.*

II. *When* P, T, R, *are given to find* U.

RULE. $\frac{tr+1}{ttr-r+3t}:\times 2t=$ U.

EXAMPLES.

67. If the preſent worth of a ſalary be 660*l.* to continue 5 years, at 5 *per cent.* what was the ſalary? *Anſ.* £150.

$$\overline{5\times{,}05}+1=1{,}25.\quad \overline{5\times5\times{,}05}-\overline{5\times{,}05}+10=11,$$

$$\textit{then}\ \frac{1{,}25}{11}\times660\times2=150$$

68. There is a houſe let upon leaſe $5\frac{1}{2}$ years to come,—I deſire to know the yearly rent, when the preſent worth, at $4\frac{1}{2}$ *per cent.* is 291*l.* 6*s.* 3*d.*? *Anſ.* £60.

69. What annuity is that which for 7 years continuance at 6 *per cent.* produces 1454*l.* 4*s.* 6*d.* preſent worth? *Anſ.* £250.

70. What annuity is that which for 8 years continuance produces 188*l.* for the preſent worth at 5 *per cent.* *Anſ.* £28.

NOTE. *When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by* 4 p; *and when quarterly, take one fourth of the ratio, four times the number of years and multiply by* 8 p.

71. There is an annuity, payable half-yearly for 5 years to come—what is the yearly rent, when the preſent worth at 5 *per cent.* is 667*l.* 10*s.*? *Anſ.* £150.

72. There is an annuity, payable quarterly, for 5 years to come—I deſire to know the yearly income, when the preſent worth at 5 *per cent.* is 671*l.* 5*s.*? *Anſ.* £150.

III. *When* U, P, T, *are given to find* R.

RULE. $\frac{\overline{ut-p}\times 2}{2pt+ut-utt}=R.$

EXAMPLES.

73. At what rate *per cent.* will an annuity of 150*l.* *per annum,* to continue 5 years, produce the preſent worth of 660*l.* *Anſ.* 5 *per cent.*

$\overline{150\times5-660}\times2=180$ $\overline{2\times660\times5}+\overline{150\times5}-\overline{150\times5\times5}$ $=3600$, *then* 180÷3600=,05=5 *per cent.*

74. If a yearly rent of 60*l.* *per annum,* to continue $5\frac{1}{2}$ years, produce 291*l.* 6*s.* 3*d.* for the preſent worth, what is the rate *per cent.*? *Anſ.* $4\frac{1}{2}$ *per cent.*

75. If an annuity of 250*l.* *per annum,* to continue 7 years, produce 1454*l.* 4*s.* 6*d.* for the preſent worth, what is the rate *per cent.*? *Anſ.* 6 *per cent.*

76. If a penſion of 28*l.* *per annum,* to continue 8 years, produces 188*l.* for the preſent worth, what is the rate *per cent.*? *Anſ.* 5 *per cent.*

NOTE. *When the annuities, or rents,* &c. *are to be paid half-yearly or quarterly, then,*

For half-yearly payments *take half of the annuity,* &c. *and twice the number of years, the quotient will be the ratio of half the rate* per cent—*and,*

For quarterly payments, *take a fourth part of the annuity,* &c. *and four times the number of years, the quotient will be the ratio of a fourth part of the rate* per cent.

77. An annuity of 150*l.* *per annum,* payable half-yearly, having 5 years to come, is ſold for 667*l.* 10*s.*—what is the rate *per cent.*? *Anſ.* 5 *per cent.*

78. If an annuity of 150*l.* *per annum,* payable quarterly, having 5 years to come, is ſold for 671*l.* 5*s.*—what is the rate *per cent.*? *Anſ.* 5 *per cent.*

IV. *When* U, P, R, *are given to find* T.

Rule. $\frac{2}{r}-\frac{2p}{u}-1=x$, *then* $\sqrt{\frac{2p}{ur}+\frac{xx}{4}}-\frac{x}{2}=T$.

Examples.

79. If an annuity of 150*l.* *per annum*, produce 660*l.* for the preſent worth at 5 *per cent.* what is the time of its continuance? *Anſ.* 5 *years.*

$$\frac{2}{,05}-\frac{660\times2}{150}-1=30,2\qquad\frac{660\times2}{150\times,05}=176$$

$$\frac{30,2\times30,2}{4}=228,01,\ \textit{then}\ \sqrt{228,01\times176}=20,1$$

$$20,1-\frac{30,2}{2}=5\ \textit{years.}$$

80. For what time may a ſalary of 60*l.* be purchaſed for 291*l.* 6*s.* 3*d.* at $4\frac{1}{2}$ *per cent.*? *Anſ.* $5\frac{1}{2}$ *years.*

81. For how long time may 250*l.* *per annum* be purchaſed for 1454*l.* 4*s.* 6*d.* at 6 *per cent.*? *Anſ.* 7 *years.*

82. What time may a penſion of 28*l.* *per annum* be bought for 188*l.* at 5 *per cent.*? *Anſ.* 8 *years.*

Note. *When the payments are half-yearly, the* U *will be equal to the half annuity, &c.* R *half the ratio, and* T *the number of payments; and*

When the payments are quarterly, U *will be equal to a fourth part of the annuity, &c.* R *the fourth of the ratio, and* T *the number of payments.*

83. If an annuity of 150*l.* *per annum* payable half-yearly, is ſold for 667*l.* 10*s.* at 5 *per cent.* I deſire to know the number of payments and the time to come? *Anſ.* 10 *payments*, 5 *yrs.*

84. An annuity of 150*l.* *per annum*, payable quarterly, is ſold for 671*l.* 5*s.* at 5 *per cent.* What is the number of payments and time to come? *Anſ.* 20 *payments*, 5 *years.*

ANNUITIES, &c. *taken in* REVERSION.

1. *To find the preſent worth of an annuity, &c. taken in Reverſion.*

Rule. Find the preſent worth of the yearly ſum at the given rate, and for the time of its continuance, *thus,* $\frac{ttr-tr+2t}{2tr+2}:\times u=P$,

2. Change P into A and find what principal being put to intereſt will amount to A at the ſame rate and for the time to come, before the annuity, &c. commences, *thus*,

$$\frac{a}{tr+1}=P.$$

EXAMPLES.

85. What is the preſent worth of an annuity of 150*l.* *per annum*, to continue 5 years, but not to commence till the end of 4 years, allowing 5 *per cent.* to the purchaſer? *Anſ.* £550.

$$\frac{\overline{5\times5\times,05}-\overline{5\times,05}+\overline{2\times5}}{\overline{5\times,05\times2}+2}=4,4\times150=660,\text{ then }\frac{660}{4\times,05+1}=550$$

86. What is the preſent worth of a leaſe of 50*l.* *per annum*, for 4 years, but not to commence till the end of 5 years, allowing 4 *per cent.* to the purchaſer?

Anſ. £152 : 5 : 11.3 *qrs.*

87. A perſon having the promiſe of a penſion of 20*l.* *per annum*, for eight years, but not to commence till the end of 4 years, is willing to diſpoſe of the ſame, at 5 *per cent.* what will be the preſent worth? *Anſ.* £111 : 18 : 1, 14*d.*+

88. A legacy of 40*l.* being left for 6 years to a perſon of 15 years of age, but not to commence till he is 21; he, wanting money, is deſirous of ſelling the ſame at 4 *per cent.*—what is the preſent worth? *Anſ.* £171 : 14*s.*

2. *To find the yearly income of an annuity, &c. in Reverſion.*

RULE. 1. Find the amount of the preſent worth at the given rate, and for the time before the reverſion *thus*,

$$ptr+p=A.$$

2. Change A into P, and find what annuity being ſold will produce P, at the ſame rate, and for the time of its continuance, *thus*,

$$\frac{tr+1}{ttr-tr+2t}:\times 2p=U$$

EXAMPLES.

89. A perſon having an annuity left him for 5 years, which does not commence till the end of 4 years, diſpoſed

of it for 550*l.* allowing 5 *per cent.* to the purchaſer,—what was the yearly income? *Anſ.* 150.

$$\overline{550\times4\times,05}+550=660$$

$$=,113636\times660\times2=£150. \quad \frac{5,\times05+1,}{5\times5\times,05-5\times,05+5\times2}$$

90. There is a leaſe of an houſe taken for 4 years, but not to commence till the end of 5 years, the leſſee would ſell the ſame for 152*l.* 6*s.* preſent payment, allowing 4 *per cent.* to the purchaſer—what is the yearly rent?

Anſ. £50.

91. A perſon having the promiſe of a penſion for 8 years, which does not commence till the end of 4 years, has diſpoſed of the ſame for 111*l.* 18*s.* 1,14*d.* preſent money, allowing 5 *per cent.* to the purchaſer—what was the penſion? *Anſ* £20.

92. There is a certain legacy left to a perſon of 15 years of age, which is to be continued for ſix years, but not to commence till he arrives at the age of 21; he wanting a ſum of money, ſells it for 171*l.* 14*s.* allowing 4 *per cent.* to the buyer—what was the annuity left him? *Anſ.* £40.

REBATE *or* DISCOUNT.

☞ S repreſents the ſum to be diſcounted.
P the preſent worth.
T the time.
R the ratio.

I. ***When* S, T, R, *are given to find* P.**

Rule. $\frac{s}{tr+1}=P$.

Examples.

1. What is the preſent worth of 357*l.* 10*s.* to be paid 9 months hence, at 5 *per cent?* *Anſ.* £344 : 11 : 6. 3,168 *qrs.*

$$\frac{357,5}{,75\times,05+1}=344,5783$$

2. What is the preſent worth of 275*l.* 10*s.* due 7 months hence, at 5 *per cent.* *Anſ.* £ 367 : 13 : 10,164*d.*

3. What is the preſent worth of 875*l.* 5*s.* 6*d.* due 5 months hence, at 4½ *per cent.?* *Anſ.* £859 : 3 : 3.3,2544 *qrs.* +

4. How much ready money can I receive for a note of 75*l.* due 15 months hence, at 5 *per cent.*? *Anſ.* £70 : 11 : 9,1752*d.*

II. *When* P, T, R, *are given to find* S.

Rule. $ptr+p=S$.

EXAMPLES.

5. If the preſent worth of a ſum of money, due 9 months hence, allowing 5 *per cent.* be 344*l.* 11*s.* 6*d.* 3,168 *qrs.*—what was the ſum firſt due? *Anſ.* £357 : 10*s.*

$$344.5783\times,75\times,05+344.5783=£357:10s.$$

6. A perſon owing a certain ſum, payable 7 months hence, agrees with the creditor to pay him down 267*l.* 13*s.* 10,164*d.* allowing 5 *per cent.* for preſent payment—what is the debt? *Anſ.* £257 : 10*s.*

7. A perſon receives 859*l.* 3*s.* 3*d.* 3,2544 *qrs.* for a ſum of money due 5 months hence allowing the debtor 4½ *per cent.* for preſent payment—what was the ſum due? *Anſ.* £857 : 5 : 6.

8. A perſon paid 70*l.* 11*s.* 9,1752*d.* for a debt 15 months hence, he being allowed 5 *per cent.* for the diſcount—how much was the debt? *Anſ.* £75.

III. S, P, T, *are given to find* R.

Rule. $\frac{s-p}{tp}=R$.

EXAMPLES.

9. At what rate *per cent.* will 357*l.* 10*s.* payable 9 months hence, produce 344*l.* 11*s.* 6*d.* 3,168 *qrs.* for preſent payment? *Anſ.* 5 *per cent.*

$$\frac{357.5-344.5783}{344.5783\times,75}=,05=5\ \textit{per cent.}$$

10. At what rate *per cent.* will 275*l.* 10s. payable 7 months hence, produce 267*l.* 13*s.* 10,164*d.* for preſent payment? *Anſ.* 5 *per cent.*

11. At what rate *per cent.* will 875*l.* 5*s.* 6*d.* payable 5 months hence, produce the preſent payment of 859*l.* 3*s.* 3*d.* 3,2544 *qrs.*? *Anſ.* 4½ *per cent.*

12. At what rate *per cent.* will 75*l.* payable 15 months hence produce the preſent payment of 70*l.* 11*s.* 9,1752*d.*? *Anſ.* 5 *per cent.*

IV. *When* S, P, R, *are given to find* T.

RULE. $\frac{s-p}{rp}=T$.

EXAMPLES.

13. The preſent worth of 357*l.* 10*s.* due for a certain time to come, is 344*l.* 11*s.* 6*d.* 3,168 *qrs.* at 5 *per cent.*—in what time ſhould the ſum have been paid without any rebate? *Anſ.* 9 *months.*

$$\frac{357.5-344.5783}{344.5783\times{,}05}={,}75=9 \text{ months.}$$

14. The preſent worth of 275*l.* 10*s.* due for a certain time to come, is, 267*l.* 13*s.* 10,164*d.* at 5 *per cent.*—in what time ſhould the ſum have been paid without any rebate? *Anſ.* 7 *months.*

15. A perſon receives 859*l.* 3*s.* 3*d*, 3,2544 *qrs.* for 875*l.* 5*s.* 6*d.* due at a certain time to come, allowing 4½ *per cent.* diſcount—I deſire to know in what time the debt ſhould have been diſcharged without any rebate?

Anſ. 5 *months.*

16. I have received 70*l.* 11*s.* 9,1752*d.* for a debt of 75*l.* allowing the perſon 5 *per cent.* for prompt payment—I deſire to know when the debt would have been payable without the rebate? *Anſ.* 15 *months.*

EQUATION *of* PAYMENTS.

To find the equated time for the payment of a ſum of money due at ſeveral times

RULE. Find the preſent worth of each payment for its reſpective time *thus,* $\frac{s}{tr+1}=P$.

Add all the preſent worths together; *then* $s-p=D$.

and $\frac{d}{pr}=E$.

EXAMPLES.

1. D. owes E 200*l.* whereof 40*l.* is to be paid at 3 months, 60*l.* at 6 months, and 100*l.* at nine months—at what

time may the whole debt be paid together, rebate being made at 5 *per cent.*? *Anſ.* 6 *months*, 26 *days.*

$$\frac{40}{1,0125}=39,5061\quad\frac{60}{1,025}=58,5365\quad\frac{100}{1,0375}=96,3855,$$

then $200-\overline{39,5061+58,5365+96,3855}=5,5719$

$$\frac{5,5719}{194,4281\times,05}=,57315=6 \text{ months, } 26 \text{ days.}$$

2. D owes F 800*l.* whereof 200*l.* is to be paid in 3 months, 200*l.* at 4 months, and 400*l.* at 6 months; but they agreeing to make but one payment of the whole at the rate of 5 *per cent.* rebate—the true equated time is demanded? *Anſ.* 4 *months*, 22 *days.*

3. E owes F 1200*l.* which is to be paid as follows; 200*l.* down, 500*l.* at the end of 10 months, and the reſt at the end of 20 months; but they agreeing to have one payment of the whole, rebate at 3 *per cent.*—the true equated time is demanded? *Anſ.* 1 *year*, 11 *days.*

COMPOUND INTEREST.

THE letters made uſe of in Compound Intereſt are,

A. the amount.
P. the principal.
T. the time.
R. the amount of 1*l.* for a year, at any given rate; which is thus found:

As 100 : 105 :: 1 : 1,05. As 100 : 105,5 :: 1 : 1,055.

A TABLE of the amount of 1*l.* for one year.

Rates per cent.	*Amts. of £1.*	*Rates per cent.*	*Amts. of £1.*	*Rates per cent.*	*Amts. of £.*
3	1,03	5½	1,055	8	1,08
3½	1,035	6	1,06	8½	1,085
4	1,04	6½	1,065	9	1,09
4½	1,045	7	1,07	9½	1,095
5	1,05	7½	1,075	10	1,1

A TABLE ſhewing the amount of 1*l.* for any number of years under 31, at 5 and 6 *per cent. per annum?*

Years.	*Rates*		*Years.*	*Rates*	
	5	6		5	6
1	1,05000	1,06000	16	2,18287	2,54035
2	1,10250	1,12360	17	2,29210	2,69277
3	1,15762	1,19101	18	2,40662	2,85434
4	1,21550	1,26247	19	2,52695	3,02560
5	1,27628	1,33822	20	2,65329	3,20713
6	1,34009	1,41852	21	2,78596	3,39956
7	1,40710	1,50363	22	2,92526	3,60353
8	1,47745	1,59384	23	3,07152	3,81975
9	1,55132	1,68948	24	3,22510	4,04893
10	1,62889	1,79084	25	3.38635	4,29187
11	1,71034	1,89829	26	3.55567	4,54938
12	1,79585	2,01219	27	3,73345	4,82234
13	1,88565	2,13292	28	3,92013	5,11168
14	1,97993	2,26090	29	4,11613	5,41838
15	2,07892	2,39655	30	4,32194	5,74349

☞ *The above table is thus made:* As 100 : 105 :: 1 : 1,05 *for the firſt year; then,* As 100 : 105 :: 1,05 : 1,025, *ſecond year, &c.*

I. *When* P. T. R, *are given to find* A.

RULE. $p \times r^t = A$.

EXAMPLES.

1. What will 225*l.* amount to in 3 years time, at 5 *per cent. per annum?* *Anſ.* 1,05 × 1,05 × 1,05 = 1,157625.
then 1,157625 × 225 = £260 : 9 : 3. 3 *qrs.*

2. What will 200*l.* amount to in 4 years, at 5 *per cent. per annum?* *Anſ.* £243. 2,025*s.*

3. What will 450*l.* amount to in 5 years, at 4 *per cent. per annum?* *Anſ* £547 : 9 : 10 : 2,0538368 *qrs.*

4. What will 500*l.* amount to in 4 years, at 5½ *per cent. per annum?* *Anſ.* £619 : 8 : 2. 3,8323 *qrs.*

II. *When* A, R, T, *are given to find* P.

RULE. $\frac{a}{r^t} = P$.

EXAMPLES.

5. What principal being put to intereſt will amount to 260*l.* 9*s.* 3*d.* 3 *qrs.* in 3 years, at 5 *per cent. per annum?*

$1,05\times1,05\times1,05=1,157625\;\frac{260,465625}{1,157625}=£225$

6. What principal being put to intereſt will amount to 243*l*, 2,025*s*. in 4 years, at 5 *per cent. per annum?* *Anſ.* £200.

7. What principal will amount to 547*l*. 9*s*. 10*d*. 2,0538368 *qrs*. in 5 years, at 4 *per cent. per annum?* *Anſ.* £450.

8. What principal will amount to 619*l*. 8*s*. 2*d*. 3,8323 *qrs*. in 4 years, at 5½ *per cent?* *Anſ.* £500.

III. ***When*** **P, A, T,** ***are given to find*** **R.**

RULE. $\frac{a}{p}=rt$ *which being extracted by the rule of extraction (the time given to the queſtion ſhewing the power) will give* R.

EXAMPLES.

9. At what rate *per cent.* will 225*l*. amount to 260*l*. 9*s*. 3*d*. 3 *qrs*. in 3 years? *Anſ.* 5 *per cent.*

$\frac{260,465625}{225}=1,157625$, *the cube root of which, (it being the third power)* $=1,05=5$ *per cent.*

10. At what rate *per cent.* will 200*l*. amount to 243*l*. 2,025*s*. in 4 years? *Anſ.* 5 *per cent.*

11. At what rate *per cent.* will 245*l*. amount to 547*l*. 9*s*. 10*d*. 2,0538368 *qrs*. in 5 years? *Anſ.* 4 *per cent.*

12. At what rate *per cent.* will 500*l*. amount to 619*l*. 8*s*. 2*d*. 3,8323 *qrs* in 4 years? *Anſ.* 5½ *per cent.*

IV. ***When*** **P, A, R,** ***are given to find*** **T.**

RULE. $\frac{a}{p}=rt$ *which being continually divided by* R, *till nothing remains, the number of thoſe diviſions will be equal to* T.

EXAMPLES.

13. In what time will 225*l*. amount to 260*l*. 9*s*. 3*d*. 3 *qrs*. at 5 *per cent?*

$\frac{260,465625}{225}=1,157625\;\frac{1,157625}{1,05}=1,1025\;\frac{1,1025}{1,05}=1,05\;\frac{1,50}{1,05}$ $=1$; *the number of diviſions bing* 3 *times ſought.*

14. In what time will 200*l*. amount to 243*l*. 2,025*s*. at 5 *per cent?* *Anſ.* 4 *years.*

15. In what time will 450*l.* amount to 547*l.* 9*s.* 10*d.* 2,0538368 *qrs.* at 4 *per cent.?* *Anſ.* 5 *years.*

16. In what time will 500*l.* amount to 619*l.* 8*s.* 2*d.* 3,8323 *qrs.* at 5½ *per cent.?* *Anſ.* 4 *years.*

ANNUITIES, *or* PENSIONS *in* ARREAR.

☞ U *repreſents the* annuity, penſion, *or* yearly rent; A, R, T, *as before.*

A TABLE ſhewing the amount of 1*l.* annuity for any number of years under 31, at 5 and 6 *per cent. per annum.*

Years.	5 *Rates*	6	*Years.*	5 *Rates*	6
1	1,00000	1,00000	16	23,65749	25,67252
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,13238	30,90565
4	4,31012	4,37461	19	30,53900	33,75999
5	5,52563	5,63709	20	33,06595	36,78559
6	6,80191	6,97532	21	35,71925	39,99272
7	8,14200	8,39383	22	38,50521	43,39229
8	9,54910	9,89746	23	41,43047	46,99582
9	11,02656	11,49131	24	44,50199	50,81557
10	12,57789	13,18079	25	47,72709	54,86451
11	14,20678	14,97164	26	51,11345	59,15638
12	15,91712	16,86994	27	54,66912	63,70576
13	17,71298	18,88213	28	58,40258	68,52811
14	19,59863	21,01506	29	62,32271	73,63979
15	21,57856	23,27597	30	66,43884	79,05818

☞ *The above table is made thus: take the firſt year's amount, which is* 1*l.* *multiply it by* 1,05 + 1 = 2,05 = *ſecond year's amount, which alſo multiply by* 1,05 + 1 = 3,1525 = *third year's amount.*

I. *When* U, T, R, *are given to find* A.

RULE. $\frac{ur^{t}-}{r-1} = \text{A}$, *or by the table thus:*

Multiply the amount of 1*l.* for the number of years, and at the rate *per cent.* given in the queſtion, by the annuity, penſion, &c. and it will give the anſwer.

EXAMPLES.

EXAMPLES.

17. What will the annuity of 50*l.* *per annum*, payable yearly, amount to in 4 years at 5 *per cent.?*

Anſ. $1{,}05\times1{,}05\times1{,}05\times1{,}05\times50=60{,}77531250$, *then* $\frac{60{,}7753125-50}{1{,}05-1}=$ £215 : 10 : 1. 2 *qrs. or,* *by the table thus,* $4{,}31012\times50=$ £215 : 10 : 1. 1,76 *qrs.*

18. What will a penſion of 45*l.* *per annum*, payable yearly, amount to in 5 years. at 5 *per cent.?*

Anſ. £248 : 13*s.* 3,27 *qrs.*

19. If a ſalary of 40*l.* *per annum*, to be paid yearly, be forborne 6 years, at 6 *per cent.*—what is the amount?

Anſ. £279. 3,072*d.*

20. If an annuity of 75*l.* *per annum*, payable yearly, be omitted to be paid for 10 years, at 6 *per cent.*—what is the amount? *Anſ.* £988 : 11*s.* 2,22*d.*

II. *When* A, R, T, *are given to find* U.

RULE. $\frac{ar-a}{r^{t}-1}=$U.

EXAMPLES.

21. What annuity being forborne 4 years, will amount to 215*l.* 10*s.* 1*d.* 2 *qrs.* at 5 *per cent.?*

Anſ. $\frac{215{,}50625\times1{,}05-215{,}50625}{1{,}05\times1{,}05\times1{,}05\times1{,}05-1}=$ £50.

22. What penſion being forborne 5 years, will amount to 248*l.* 13*s.* 3,27 *qrs.* at 5 *per cent.?* *Anſ.* £45.

23. What ſalary, being omitted to be paid 6 years, will amount to 279*l.* 3,072*d.* at 6 *per cent.?* *Anſ.* £40.

24. If the payment of an annuity, being forborne 10 years, amount to 988*l.* 11*s.* 2,22*d.* at 6 *per cent.*—what is the annuity? *Anſ.* £75.

III. *When* U, A, R, *are given to find* T.

RULE. $\frac{ar+u-a}{u}=t$ *which being continually divided by* R *till nothing remains, the number of thoſe diviſions will be equal to* T.

EXAMPLES.

25. In what time will 50*l.* *per annum* amount to 215*l.* 10*s.* 1*d.* 2 *qrs.* at 5 *per cent.* for non-payment?

Anſ. $\frac{215,50625 \times 1.05 \times 50 - 215,50625}{50} = 1,21550625$, *which being continually divided by* R, *the number of thoſe diviſions will be* 4 *years.*

26. In what time will 45*l.* *per annum* amount to 248*l.* 13*s.* 3,27 *qrs.* allowing 5 *per cent.* for forbearance of payment? *Anſ.* 5 *years.*

27. In what time will 40*l.* *per annum* amount to 279*l.* 3,072*d.* at 6 *per cent.*? *Anſ.* 6 *years.*

28. In what time will 75*l.* *per annum* amount to 988*l.* 11*s* 2,22*d.* allowing 6 *per cent.* for forbearance of payment? *Anſ.* 10 *years.*

PRESENT WORTH *of* ANNUITIES, PENSIONS, &c.

A TABLE ſhewing the preſent worth of 1*l.* annuity for any number of years under 31, rebate at 5 and 6 *per cent.*

Years.	5 *Rates*	6	*Years.*	5 *Rates*	6
1	0,95238	0,94339	16	10,83777	10,10589
2	1,85941	1,83339	17	11,27406	10,47726
3	2,72324	2,67301	18	11,68958	10,82760
4	3,54595	3,46510	19	12,08532	11,15811
5	4,32947	4,21236	20	12,46221	11,46992
6	5,07569	4,91732	21	12,82115	11,76407
7	5,78637	5,58238	22	13,16300	12,04158
8	6,46321	6,20979	23	13,48857	12,30338
9	7,10782	6,80169	24	13,79864	12,55035
10	7,72173	7,36008	25	14,09394	12,78335
11	8,30641	7,88687	26	14,37518	13,00316
12	8,86325	8,38384	27	14,64303	13,21053
13	9,39357	8,85268	28	14,89812	13,40616
14	9,89864	9,29498	29	15,14107	13,59072
15	10,37965	9,71225	30	15,37245	13,76483

☞ *The above table is thus made: divide* 1*l.* *by* 1,05 = ,95238, *the preſent worth of the firſt year, which* ÷ 1,05 = ,7073, *added to the firſt year's preſent worth* = 1,85741, *the*

the ſecond year's preſent worth; *then*, ,90703÷1,05 *and the quotient added to* 1,85941=2,72324, *third year's preſent worth*, *&c.*

I. *When* U, T, R, *are given to find* P.

$$\text{RULE. } \frac{u - \frac{u}{rt}}{r - 1} = \text{P.}$$

Or, by the table thus:

Multiply the preſent worth of 1l. annuity for the time and rate *per cent.* given, by the annuity, penſion, &c. it will give the anſwer.

EXAMPLES.

29. What is the preſent worth of an annuity of 30l. *per annum*, to continue 7 years, at 6 *per cent.*?

Anſ. £167 : 9 : 5,184*d.*

$\frac{30}{1{,}50363} = 19{,}9517$. $30 - 19{,}9517 = 10{,}0483$. $\frac{10{,}0483}{1{,}06 - 1} = 167{,}4716$. *By the table* $5{,}58238 \times 30 = 167{,}4716$.

30. What is the preſent worth of a penſion of 40l. *per annum*, to continue 8 years, at 5 *per cent.*?

Anſ. £258 : 10 : 6. 3,164 *qrs.*

31. What is the preſent worth of a ſalary of 35*l.* to continue 7 years, at 6 *per cent.*? *Anſ.* £195 : 7 : 7. 3,968 *qrs.*

32. What is the yearly rent of 50l. to continue 5 years, worth in ready money, at 5 *per cent.*?

Anſ. £216 : 9 : 5. 2,56 *qrs.*

II. *When* P, T, R, *are given to find* U.

$$\text{RULE. } \frac{prt \times r - prt}{rt - 1.} = \text{U.}$$

EXAMPLES.

33. If an annuity be purchaſed for 167*l.* 9·. 5,184*d.* to be continued 7 years at 6 *per cent.* what is the annuity?

$$\textit{Aſ.}\ \frac{\overline{167{,}4716 \times 1{,}50363 \times 1{,}06} - 167{,}4716 \times 1{,}50363}{1{,}50363 - 1} = £30$$

34. If the preſent payment of 258*l.* 10*s.* 6*d.* 3,264 *qrs.* be made for a ſalary 8 years to come, at 5 *per cent.*—what is the ſalary? *Anſ.* £40.

35. If the preſent payment of 195*l.* 7*s.* 7*d.* 3,968 *qrs.* be required for a penſion of 7 years to come, at 6 *per cent.* what is the penſion? *Anſ.* £35.

36. If the preſent worth of an annuity, 5 years to come be 216*l.* 9*s.* 5*d.* 2,56 *qrs.* at 5 *per cent.*—what is that annuity? *Anſ.* £50.

III. *When* U, P, R, *are given to find* T.

Rule. $\frac{u}{p+u-pr}=rt$ *which being continually divided by* R, *till nothing remains, the number of thoſe diviſions will be equal to* T.

Examples.

37. How long may a leaſe of 30l. yearly rent be had for 167*l.* 9*s.* 5*d.* ,184*d.* allowing 6 *per cent.* to the purchaſer?

Anſ. $\frac{30}{167{,}4716+30-177{,}5198}=1{,}50363$ *which being continually divided the number of thoſe diviſions will be* = *to* T = 7 *years.*

38. If 258*l.* 10*s.* 6*d.* 3,264 *qrs.* is paid down for a leaſe of 40*l.* *per annum* at 5 *per cent.*—how long is the leaſe purchaſed for? *Anſ.* 8 *years.*

39. If a houſe is let upon leaſe for 35*l.* *per annum,* and the leſſee makes preſent payment of 195*l.* 7*s.* 8*d.* he being allowed 6 *per cent.*—I demand how long the leaſe is purchaſed for? *Anſ.* 7 *years.*

40. For what time may a leaſe of 50*l.* *per annum* be purchaſed, when preſent payment is made of 216*l.* 9*s.* 5*d.* 2,56 *qrs.* at 5 *per cent.*? *Anſ.* 5 *years.*

ANNUITIES, LEASES, &c. *taken in* REVERSION.

To find the preſent worth of Annuities, Leaſes, &c. taken in Reverſion.

Rule 1. Find the preſent worth of the annuity, &c. at the given rate, and for the time of its continuance, *thus,*

$$\frac{u-\frac{u}{rt}}{r-1}=P.$$

2. Change P into A and find what principal being put to intereſt will amount to P at the ſame rate, and for the time to come, before the annuity commences, which will be the preſent worth of the annuity, &c. *thus,*

$$\frac{a}{r}=P.$$

EXAMPLES.

41. What is the preſent worth of a reverſion of a leaſe of 40*l.* *per annum*, to continue for 6 years, but not to commence till the end of 2 years, allowing 6 *per cent.* to the purchaſer? *Anſ.* £175 : 1 : 1. 2,048 *qrs.*

$$\frac{40}{1,41852}=28,1984\ \frac{40-28,1984}{1,06-1}=196,6933.\ \frac{196,6933}{1,1236}=175,0563.$$

42. What is the preſent worth of a reverſion of a leaſe of 60*l.* *per annum*, to continue for 7 years, but not to commence till the end of 3 years, allowing 5 *per cent.* to the purchaſer? *Anſ.* £299 : 18 : 2,4*d.*

43. There is a leaſe of a houſe at 30*l.* *per annum*, which is yet in being for 4 years, and the leſſee is deſirous to take a leaſe in reverſion for 7 years, to begin when the old leaſe ſhall be expired—what will be the preſent worth of the ſaid leaſe in reverſion, allowing 5 *per cent.* to the purchaſer? *Anſ.* £142 : 16 : 3. 2,688 *qrs.*

To find the yearly income of an annuity, &c. taken in Reverſion.

RULE. Find the amount of the preſent worth, at the given rate, and for the time before the annuity commences, *thus*,

$$prt=A.$$

Change A into P, and find what yearly rent being ſold will produce P, at the ſame rate, and for the time of its continuance, which will be the yearly ſum required. *thus*,

$$\frac{prt\times r-prt}{rt-1}=U.$$

EXAMPLES.

44. What annuity to be entered upon two years hence, and then to continue 6 years, may be purchaſed for 175*l.* 1*s.* 1*d.* 2,048 *qrs.* at 6 *per cent.*

Anſ. $175,0563\times1,1236=196,6933.$

then $$\frac{196,6933\times1,41852\times1,06-279,01337}{1,41852-1}=£40.$$

45. The preſent worth of the leaſe of an houſe is 299*l.* 18*s.* 2*d.* 4*d.* taken in reverſion for 7 years, but not to commence till the end of 3 years, allowing 5 *per cent.* to the purchaſer—what is the yearly rent? *Anſ.* £60

46. There is a leaſe of a houſe in being for 4 years, and the leſſee being minded to take a leaſe in reverſion for 7 years, to begin when the old leaſe ſhall be expired, paid down 142*l.* 16*s.* 3*d.* 2,688 *qrs.*—what was the yearly rent of the houſe, when the leſſee was allowed 5 *per cent.* for preſent payment? *Anſ.* £30.

Purchaſing FREEHOLD *or* REAL ESTATES *is ſuch as are bought to continue for ever.*

I. *When* U, R, *are given to find* W.

RULE. $\frac{u}{r-1}=$W.

EXAMPLES.

47. What is the worth of a freehold eſtate of 50*l.* *per annum*, allowing 5 *per cent.* to the buyer?

Anſ. $\frac{50}{1,05-1}=$£1000.

48. What is an eſtate of 140*l.* *per annum*, to continue for ever, worth in preſent money, allowing 4 *per cent.* to the buyer? *Anſ.* £3500.

49. If a freehold eſtate of 75*l.* yearly rent was to be ſold, what is the worth, allowing the buyer 6 *per cent.*? *Anſ.* £1250.

II. *When* W, R, *are given to find* U.

RULE. $\overline{w\times r-1}=$U.

EXAMPLES.

50. If a freehold eſtate is bought for 1000*l.* and the allowance of 5 *per cent.* is made to the buyer—what is the yearly rent? *Anſ.* 1,05—1=,05, *then* 1000×,05=£50.

51. If an eſtate be ſold for 3500*l.* and 4 *per cent.* allowed to the buyer—what is the yearly rent? *Anſ.* £140.

52. If a freehold eſtate is bought for 1250*l.* preſent money, and an allowance of 6 *per cent.* made to the buyer for the ſame—what is the yearly rent? *Anſ.* £75.

III. *When* W, U, *are given to find* R.

RULE. $\frac{w+u}{w}=$R.

EXAMPLES.

EXAMPLES.

53. If an eſtate of 50*l.* *per annum* be bought for 1000*l.* —what is the rate *per cent.?*

Anſ. $\frac{1000+50}{1000}=1{,}05=5$ *per cent.*

54. If a freehold eſtate of 140*l.* *per annum* be bought for 3500*l.*—what was the rate *per cent.* allowed? *Anſ.* 4 *per cent.*

55. If an eſtate of 75*l.* *per annum* is ſold for 1250*l.*—what is the rate *per cent.* allowed? *Anſ.* 6 *per cent.*

Purchaſing FREEHOLD ESTATES *in* REVERSION.

To find the worth of a freehold eſtate in reverſion.

RULE. Find the worth of the yearly rent, *thus,* $\frac{u}{r-1}=$W.

Change W into A, and find what principal being put to intereſt, will amount to A at the ſame rate, and for the time to come, before the eſtate commences, and that will be the worth of the eſtate in reverſion: *thus,* $\frac{a}{r^t}=$P.

EXAMPLES.

56. If a freehold eſtate of 50*l.* *per annum,* to commence 4 years hence, is to be ſold—what is it worth, allowing the purchaſer 5 *per cent.* for preſent payment?

Anſ. $\frac{50}{1{,}05-1}$ 1000, *then* $\frac{1000}{1{,}2155}=$£822:14:1. 2 *qrs.*+

57. What is an eſtate of 200*l.* to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaſer 4 *per cent.?* *Anſ.* £4632:15:7. ,44 *qrs.*

58. What is an eſtate of 240*l.* *per ann.* worth in ready money, to continue for ever, but not to commence till the end of three years, allowance being made at 6 *per cent.?*

Anſ. £3358 : 9 : 6. 2,24 *qrs.*

To find the yearly rent of an eſtate taken in reverſion.

RULE. Find the amount of the worth of the eſtate, at the given rate and time, before it commences, *thus,* $wrt=$A.

Change A into W, and find what yearly rent being ſold will produce U, at the ſame rate; which will be the yearly rent required, *thus,* $\frac{\overline{wr\times r}-wr.}{r}=$U.

EXAMPLES.

59. If a freehold eſtate, to commence 4 years hence, is ſold for 822*l.* 14*s.* 1*d.* 2 *qrs.* allowing the purchaſer 5 *per cent.*—what is the yearly income?

$$\textit{Anſ.}\ \underline{822{,}07625 \times 1{,}2155 = 1000}.$$

$$\textit{then}\ \frac{1000 \times 1{,}05 \times 1{,}05 - 1050}{1{,}05} = £50.$$

60. A freehold eſtate is bought for 5622*l.* 15*s.* 7,44*d.* which does not commence till the end of 2 years, the buyer being allowed 4 *per cent.* for his money—I deſire to know the yearly income? *Anſ.* £200.

61. There is a freehold eſtate ſold for 3358*l.* 9*s.* 6*d.* 2,24 *qrs.* but not to commence till the expiration of 3 years, allowing 6 *per cent.* for preſent payment—what is the yearly income? *Anſ.* £240.

REBATE *or* DISCOUNT.

A TABLE ſhewing the preſent worth of 1*l.* due any number of years, to commence under 31, rebate at 5 and 6 *per cent.*

Years.	5 *Rates.*	6	*Years.*	5 *Rates*	6
1	,952381	,943396	16	,458111	,393647
2	,907030	,889996	17	,436296	,371364
3	,863838	,839619	18	415520	,350343
4	,822702	,792093	19	,395734	,330513
5	,783526	,747258	20	,376889	,311804
6	,746215	704960	21	,358942	,294155
7	,710682	,665057	22	341849	,277505
8	,676839	,627412	23	,325571	,261797
9	,644609	,591898	24	,310067	,246978
10	,613913	,558394	25	,295302	,232998
11	,584679	,526787	26	,281240	,219810
12	,556837	,496969	27	,267848	,207368
13	,530321	,468839	28	,255093	,195630
14	,505068	,442301	29	,242946	,184556
15	,481017	,417265	30	,231377	,174110

☞ *The above Table is thus made:* 1÷1,05=,952381 *firſt year's preſent worth;* ,952381÷1,05=,90703 *ſecond year; and* ,9073÷1,05=,863838 *third year, &c.*

When S, T, R, *are given to find* P.

I. RULE. $\frac{s}{r^t} = P$.

EXAMPLES.

1. What is the preſent worth of 315*l.* 12*s.* 4,2*d.* payable 4 years hence at 6 *per cent.*?

Anſ. $1,06 \times 1,06 \times 1,06 \times 1,06 = 1,26247$. *then*

By the Table.

$$\frac{315,6175}{1,26247} = \pounds 250 \qquad \begin{array}{r} 315,6175 \\ ,792093 \\ \hline \hline 249,9984124275 \\ \hline \hline \end{array}$$

2. If 344*l.* 14*s.* 9*d.* 1 92 *qrs.* be payable in 7 years time, what is the preſent worth, rebate being made at 5 *per cent.*?

Anſ. £245.

3. There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* which is payable 4 years hence, but it is agreed to be paid in preſent money—what ſum muſt the creditor receive, rebate being made at 6 *per cent.*? *Anſ.* £350.

II. *When* P, T, R, *are given to find* S.

RULE. $p \times r^t = S$.

EXAMPLES.

4. If a ſum of money, due 4 years hence, produce 250*l.* for the preſent payment, rebate being made at 6 *per cent.* —what was the ſum firſt due?

Anſ. $250 \times 1,26247 = \pounds 315 : 12 : 4,2d.$

5. If 245*l.* be received for a debt payable 7 years hence, and an allowance of 5 *per cent.* to the debtor for preſent payment—what was the debt? *Anſ.* £344 : 14 : 9. 1,92 *qrs.*

6. There is a ſum of money due at the expiration of 4 years, but the creditor agrees to take 350*l.* for preſent payment, allowing 6 *per cent.*—what was the debt?

Anſ. £441 : 17 : 3. 1,92 *qrs.*

III. *When* S, P, R, *are given to find* T.

RULE. $\frac{s}{p} = t$ *which being continually divided by* R, *till nothing remains, the number of theſe diviſions will be equal to* T.

EXAMPLES.

7. The preſent payment of 250*l.* is made for a debt of 315*l.* 12*s.* 4,2*d.* rebate at 6 *per cent.*—in what time was the debt payable?

Anſ. $\frac{315,6175}{250} = 1,26247$ *which being continually divided, thoſe diviſions will be equal to* 4, $=$ *the number of years.*

8. A perſon receives 245*l.* now, for a debt of 344*l.* 14*s.* 9*d.* 1,92 *qrs.* rebate being made at 5 *per cent.*—I demand in what time the debt was payable? *Anſ.* 7 *years.*

9. There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* due at a certain time to come, but 6 *per cent.* being allowed to the debtor for the preſent payment of 350*l.*—I deſire to know in what time the ſum ſhould have been made without any rebate? *Anſ.* 4 *years.*

IV. *When* S, P, T, *are given to find* R.

RULE. $\frac{s}{p} = r^t$ *which being extracted by the rules of extraction, (the time given in the queſtion ſhewing the power) will be equal to* R.

EXAMPLES.

10. A debt of 315*l.* 12*s.* 4,2*d.* is due 4 years hence, but it is agreed to take 250*l* now—what is the rate *per cent.* that the rebate is made at?

Anſ. $\frac{315,6175}{250} = 1,26247; \sqrt[4]{1,26247} = 1,06 = 6$ *per cent.*

11. The preſent worth of 344*l.* 14*s.* 9*d.* 1,92 *qrs.* payable 7 years hence, is 245*l.*—at what rate *per cent.* is rebate made? *Anſ.* 5 *per cent.*

12. There is a debt of 441*l.* 17*s.* 3*d.* 1,92 *qrs.* payable in 4 years time, but it is agreed to take 350*l.* preſent payment—I deſire to know what rate *per cent.* rebate is made at? *Anſ.* 6 *per cent.*

PART IV.

DUODECIMALS:

Or, what is generally called

Croſs Multiplication, and ſquaring of Dimenſions by ARTIFICERS *and* WORKMEN.

RULE *for* MULTIPLYING DUODECIMALLY.

1. UNDER the multiplicand write the correſponding denominations of the multiplier.

2. Multiply each term in the multiplicand (beginning at the loweſt) by the feet in the multiplier; write each reſult under its reſpective term, obſerving to carry an unit for every 12, from each lower denomination to its next ſuperior.

3. In the ſame manner multiply the multiplicand by the primes in the multiplier, and write the reſult of each term one place more to the right-hand of thoſe in the multiplicand.

4. Work in the ſame manner with the ſeconds in the multiplier, ſetting the reſult of each term two places to the right-hand of thoſe in the multiplicand, and ſo on for thirds, fourths, &c.

EXAMPLES.

f. in. *f. in.*
1. Multiply 7 : 9 by 3 : 6.

Croſs Multiplication.	*Practice.*	*Duodecimals.*	*Decimals.*
7 × 9	6½ 7 : 9	7 : 9	7,75
3 6	3 : 6	3 : 6	3,5
21:0:0=7×3	23 : 3	23 : 3 ×3	3875
2:3:0=9×3	3 : 10 : 6	3 : 10 : 6×6	2325
3:6:0=7×6			
0:4:6=9×6	27 : 1 : 6	27 : 1 : 6	27,125
27 : 1 : 6			

		f. in. p.		*f. in. p.*		*f. in. parts.*
2.	Mult.	8 : 5	by	4 : 7	*Facit*	38 : 6 : 11
3.	Mult.	9 : 8	by	7 : 6	*F.*	72 : 6 : 0
4.	Mult.	8 : 1	by	3 : 5	*F.*	25 : 7 : 5
5.	Mult.	7 : 6	by	5 : 9	*F.*	43 : 1 : 6
6.	Mult.	4 : 7	by	3 : 10	*F.*	17 : 6 : 10
7.	Mult.	7 : 5 : 9	by	3 : 5 : 3	*F.*	25 : 8 : 6 : 2 : 3
8.	Mult.	10 : 4 : 5	by	7 : 8 : 6	*F.*	79 : 11 : 0 : 6 : 6
9.	Mult.	75 : 7	by	9 : 8	*F.*	730 : 7 : 8
10.	Mult.	97 : 8	by	8 : 9	*F.*	854 : 7 : 0
11.	Mult.	57 : 9	by	9 : 5	*F.*	543 : 9 : 9
12.	Mult.	75 : 9	by	17 : 7	*F.*	1331 : 11 : 3
13.	Mult.	87 : 5	by	35 : 8	*F.*	3117 : 10 : 4
14.	Mult.	179 : 3	by	38 : 10	*F.*	6960 : 10 : 6
15.	Mult.	259 : 2	by	48 : 11	*F.*	12677 : 6 : 10
16.	Mult.	257 : 9	by	39 : 11	*F.*	10288 : 6 : 3
17.	Mult.	311 : 4 : 7	by	36 : 7 : 5	*F.*	11402 : 2 : 4 : 11 : 11
18.	Mult.	321 : 7 : 3	by	9 : 3 : 6	*F.*	2988 : 2 : 10 : 4 : 6

The APPLICATION.

Artificers' work is computed by different meaſures, viz.

1. Glazing and maſons' flat-work by the foot.

2. Painting, plaiſtering, paving, &c. by the yard.

3. Partitioning, flooring, roofing, tiling, &c. by the ſquare of 100 feet.

4. Brickwork, &c. by the rod or 16½ feet, whoſe ſquare is 272¼.

MEASURING *by the* FOOT SQUARE, *as* GLAZIERS' *and* MASONS' *flat-work.*

EXAMPLES.

19. There is a houſe with three tier of windows, 3 in a tier, the height of the firſt tier is 7 feet 10 inches, the ſecond 6 feet 8 inches, and the third 5 feet 4 inches, the breadth of each is 3 feet 11 inches—what will the glazing come to at 1¼*d. per* foot?

Duodecimals
7 : 10 *the*
6 : 8 *heights*
5 : 4 *added*
19 : 10
3 = *windows*
59 : 6 *in a tier*
3 : 11 *in a breadth*
178 : 6
54 : 6 : 6
233 : 0 : 6

feet *in.* *pts.*
233 : 0 : 6 *at* 14*d. per foot.*
2*d.* $\frac{1}{6}$ 233 = 1*s.*
38 : 10 = 2*d.*
$\frac{1}{2}$ = 6 *parts.*
2|0)27|1 : 10$\frac{1}{2}$
Anſ. £13 : 11 : 10$\frac{1}{2}$

20. What is the worth of 8 ſquares of glaſs, each meaſuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 4$\frac{1}{8}$*d. per* foot? *Anſ.* £1 : 18 : 9.

21. There are 8 windows to be glazed, each meaſures 1 foot 6 inches wide, and 3 feet in height—how much will they come to at 7$\frac{3}{4}$*d. per* foot? *Anſ.* £1 : 3 : 3.

22. What is the price of a marble ſlab, whoſe length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6*s. per* foot? *Anſ.* £3 : 1 : 5.

MEASURING *by the* YARD SQUARE, *as* PAIVORS, PAINTERS, PLAISTERERS, *and* JOINERS.

☞ *Divide the ſquare feet by 9, and it will give the number of ſquare yards.*

EXAMPLES.

23. A room is to be cieled, whoſe length is 74 feet 9 inches, and width 11 feet 6 inches—what will it come to at 3*s.* 10$\frac{1}{2}$*d. per* yard? *Anſ.* £18 : 10 : 1.

24. What will the paving of a court-yard come to at 4$\frac{3}{4}$*d. per* yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches? *Anſ.* £7 : 0 : 10.

25. A room painted 97 feet 8 inches about, and 9 feet 10 inches high—what does it come to at 2*s.* 8$\frac{3}{4}$*d. per* yard? *Anſ.* £14 : 11 : 1.

27. What is the content of a piece of wainſcotting in yards ſquare, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at 6*s.* 7$\frac{1}{2}$*d. per* yard? *Anſ.* £1 : 19 : 5.

27. What will the paving of a court-yard come to at 3*s.* 2*d.* *per* yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches? *Anſ.* £7 : 4 : 5.

28. A perſon has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a foot-way the depth of the court, of 5 feet 6 inches in breadth: the foot-way is laid with Purbeck ſtone, at 3*s.* 6*d.* *per* yard, and the reſt with pebbles, at 3*s.* *per* yard—what will the whole come to? *Anſ.* £49 : 17*s.*

29. What will the plaiſtering of a cieling, at 10*d.* *per* yard come to, ſuppoſing the length at 21 feet 8 inches, and the breadth 14 feet 10 inches? *Anſ.* £1 : 9 : 9.

30. What will the wainſcotting of a room come to at 6*s.* *per* ſquare yard, ſuppoſing the height of the room (taking in the cornice and moulding) is 12 feet 6 inches, and the compaſs 83 feet 8 inches, the three window ſhutters, each 7 feet 8 inches, by 3 feet 6 inches; and the door 7 feet by 3 feet 6 inches; the ſhutters and door being worked on both ſides, is reckoned work and half work? *Anſ.* £36 : 12 : 2½*d.*

MEASURING *by the* SQUARE *of* 100 *feet, as* FLOORING, PARTITIONING, ROOFING, TILING, &*c.*

EXAMPLES.

31. In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning—how many ſquares?
Anſ. 18 *ſquares,* 39 *feet,* 8 *inches,* 10 *parts.*

32. If a houſe of 3 ſtories, beſides the ground-floor, was to be floored at 6*l.* 10*s.* *per* ſquare, and the houſe meaſured 20 feet 8 inches, by 16 feet 9 inches: There are 7 fire places, whoſe meaſures are two of 6 feet, by 4 feet 6 inches each, two of 6 feet by 5 feet four inches each, and two of 5 feet 8 inches, by 4 feet 8 inches, and the ſeventh of 5 feet 2 inches, by 4 feet, and the well-hole of the ſtairs is 10 feet 6 inches, by 8 feet 9 inches—what will the whole come to? *Anſ.* £53 : 13 : 3¼.

33. If a houſe meaſures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, and the roof be of a true pitch—what will it come to roofing at 10*s.* 6*d.* *per* ſquare? *Anſ.* £12 : 12 : 11¾.

Note. *In tiling, roofing, and ſlating, it is cuſtomary to reckon the flat and half of any building within the wall, to be* *be the meaſure of the roof of that building, when the ſaid roof is of a true pitch*, i. e. *when the rafters are $\frac{3}{4}$ of the breadth of the building; but if the roof is more or leſs than the true pitch, they meaſure from one ſide to the other, with a rod or ſtring.*

34. What will the tiling of a barn coſt, at 25*s.* 6*d. per* ſquare, the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave-boards projecting 16 inches on each ſide? *Anſ.* £24 : 9 : 5$\frac{1}{2}$.

MEASURING *by the* ROD.

Note, *Bricklayers always value their work at the rate of a brick and a half thick; and if the thickneſs of the wall be more or leſs, it muſt be reduced to that thickneſs by this rule.*

RULE. Multiply the area of the wall by the number of half bricks the thickneſs the wall is of; the product divided by 3, gives the area.

EXAMPLES.

35. If the area of a wall be 4085 feet, and the thickneſs two bricks and a half—how many rods doth it contain? *Anſ.* 25 *rods.*

36. If a garden wall be 254 feet round, and 12 feet 7 inches high, and 3 bricks thick—how many rods doth it contain? *Anſ.* 23 *rods,* 130 *feet.*

37. How many ſquare rods are there in a wall 62$\frac{1}{2}$ feet long, 14 feet 8 inches high, and 2$\frac{1}{2}$ bricks thick? *Anſ.* 5 *rods,* 167 *feet.*

38. If the ſide walls of a houſe be 28 feet 10 inches in length, and the height of the roof from the ground 53 feet 8 inches, and the gable, (or triangular part at the top) to riſe 42 courſe of bricks, (reckoning 4 courſe to a foot.) Now 20 feet high is 2$\frac{1}{2}$ bricks thick, 20 feet more at 2 bricks thick, 15 feet 8 inches more, at 1$\frac{1}{2}$ brick thick, and the gable at 1 brick thick—what will the whole work come to at 5*l.* 16*s. per* rod? *Anſ.* £48 : 13 : 5$\frac{1}{2}$.

Multiplying ſeveral figures by ſeveral, and the product to be produced in one line only.

RULE. Multiply the units of the Multiplicand by the units of the multiplier, ſetting down the units of the product,

duct, and carry the tens; next multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand, multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand multiplied by the tens in the multiplier, and the units of the multiplicand by the hundreds in the multiplier: and ſo proceed till you have multiplied the multiplicand all through, by every figure in the multiplier.

EXAMPLES.

Multiply 35234
by 52424

1847107216

35234
52424

140936
70468
140936
70468
176170

1847107216

EXPLANATION.

Firſt, $\overline{4\times4}=16$, that is, 6 and carry 1. *Secondly*, $\overline{3\times4}+\overline{4\times2}$, and 1 that is carried is 21; ſet down 1 and carry 2. *Thirdly*, $\overline{2\times4}+\overline{3\times2}+\overline{4\times4}+2$ carried $=32$; that is 2 and carry 3. *Fourthly*, $\overline{5\times4}+\overline{2\times2}+\overline{3\times4}+\overline{4\times2}+3$ carried $=47$; ſet down 7, and carry 4. *Fifthly*, $\overline{3\times4}+\overline{5\times2}+\overline{2\times4}+\overline{3\times2}+\overline{4\times5}+4$ carried $=60$; ſet down 0, and carry 6. *6thly*, $\overline{3\times2}+\overline{5\times4}+\overline{2\times2}+\overline{3\times5}+6$ carried $=51$; ſet down 1, and carry 5. *Seventhly*, $\overline{3\times4}+\overline{5\times2}+\overline{2\times5}+5$ carried $=37$; that is 7, and carry 3. *Eighthly*, $\overline{3\times2}+\overline{5\times5}+3$ carried $=34$; ſet down 4, and carry 3. *Laſtly*, $3\times5+3$ carried $=18$; which being multiplied by the laſt figure in the multiplier, ſet the whole down, and the work is finiſhed.

PART V.

The MENSURATION *of* CIRCLES, &c.

A CIRCLE is a plain figure, contained under one line which is a called a circumference, unto which all lines drawn from a point in the middle of the figure, called the centre, and falling upon the circumference, are equal the one to the other. The circle contains more ſpace than any plain figure of equal compaſs.

The proportion of the diameter of a circle to the circumference was never yet exactly found, notwithſtanding many eminent and learned men have laboured very far therein; among whom the excellent Van Culen had hitherto outdone all, in his having calculated the ſaid proportion to thirty-ſix places of decimals, which are engraven upon his tomb-ſtone in St. Peter's church, in Leyden.

Let it be required to find the area of a circle, whoſe diameter is an unit. By the proportion of Van Culen, if the diameter be 1, the circumference will be 3,14159265, &c. of which 3,1416 is ſufficient in moſt caſes. Then the rule teaches, to multiply half the circumference by half the diameter, and the product is the area; that is multiply 1,5708 by ,5, (*viz.* half 3,1416 by half 1) and the product is ,7854, which is the area of the circle, whoſe diameter is 1.

Again if the area be required when the circumference is 1, firſt find what the diameter will be, thus, as 3,1416 : 1 :: 1 : ,318309, which is the diameter when the circumference is 1. Then multiply half ,318309 by half 1 that is ,159154 by ,5, and the product is ,079577; which is the area of a circle whoſe circumference is 1.

If the area be given, to find the ſide of the ſquare equal, you need but extract the ſquare root of the area given, and it is done. So that the ſquare root of ,7854 is ,8862, which is the ſide of a ſquare equal when the diameter is 1. And if you extract the ſquare root of ,079577, it will be ,2821, which is the ſide of the ſquare equal to the circle whoſe circumference is 1.

If the ſide of a ſquare within a circle be required, if you ſquare the ſemi-diameter, and double that ſquare, and out of that ſum extract the ſquare root, that ſhall be the ſide of the ſquare, which may be inſcribed in that circle: ſo if the diameter of the circle be 1, then the half is ,5, which ſquared is ,25, and this doubled is ,5, whoſe ſquare root is ,7071, the ſide of the ſquare inſcribed.

From what has been here ſaid, the ingenious ſcholar will eaſily perceive how all other proportional numbers are found, and may examine them at pleaſure. We ſhall now proceed to the different problems.

Problem 1. Having the diameter and circumference to find the area.

Every circle is equal to a parallelogram, whoſe length is equal to half the circumference, and the breadth equal to half the diameter; therefore multiply the circumference by half the diameter, and the product is the area of the circle.

Thus, if the diameter of a circle, that is, the line drawn a-croſs the circle through the centre, be 22,6; and if the circumference be 71, the half of 71 is 35,5, and the half of 22,6 is 11,3 which multiplied together, the product is 401,15, which is the area of the circle.

Problem 2. Having the diameter of a circle, to find the circumference.

As 7 : 22, ſo is the diameter to the circumference. Or, as 113 : 355, ſo is the diameter to the circumference. Or, as 1 : 3,141593, ſo is the diameter to the circumference.

Let the diameter, as in the firſt problem, be 22,6. This multiplied by 22, and the product divided by 7, gives 71,028 for the circumference; but the two other proportions are more exact, as appear by the following work.

```
  3,141593              355
      22,6             22,6
  --------             ----
  18849558             2130
  6283186              710
 6283186              710
 ----------       -----------
 71,0000018       113)8023,0(71
 ----------            113
                       ---
                       ...
                       ---
```

Problem 3. Having the circumference of a circle, to find the diameter.

As 1 is to ,318309, ſo is the circumference to the diameter. Or, as 355 : 113, ſo is the circumference to the diameter. Or, as 22 : 7, ſo is the circumference to the diameter.

Let the circumference be 71, and then proceed with either of the above three proportions, as follow:

318309	113	71
71	71	7
318309	113	22)497(22,59
2228163	791	57
		130
22,599939	355)8023(22,6	200
	923	2
	2130	
	...	

Thus, by the ſecond proportion, the diameter is 22,6; but by the other two it falls ſomething ſhort.

Problem 4. Having the diameter of a circle, to find the area.

All circles are in proportion one to another, as are the ſquares of the diameters, (by Euclid 12. ii.) Now the area of a circle, whoſe diameter is 1, will be ,785398, according to Van Culen's proportion before-mentioned; but for practice ,7854 will be ſufficient. Therefore, as 1 (the ſquare of the diameter 1) is to ,7854, ſo is 510,76 (the ſquare of 22,6, the diameter of the given circle) to 41,15, the area of the given circle.

Problem 5. Having the circumference of a circle to find the area.

Becauſe the diameters of circles are proportioned to their circumferences; that is, as the diameter of one circle is to its circumference, ſo is the diameter of another circle to its circumference: therefore the areas of circles are to one another, as the ſquares of the circumferences. And if the circumference of a circle be 1, the area of that circle will be ,07958; then the ſquare of 1 is 1, and the ſquare of 71 (the circumference of the former circle) is 5041. Therefore it will be, as 1 : ,07958 :: 5041 : 401,16278.

Problem 6. By having the diameter, to find the ſide of a ſquare that is equal in area to that circle.

If the diameter of a circle be 1, the ſide of a ſquare equal thereunto will be ,8862. Therefore, as 1 : ,8862 :: 22,6 (the diameter) : 20,02812, the ſide of the ſquare.

Problem 7. By having the circumference, to find the ſide of the ſquare equal.

If the circumference of a circle be 1, the ſide of the ſquare equal will be ,2821. Therefore, as 1 : ,2821 :: 71 (the circumference) : 20,0291, the ſide of the ſquare.

Problem 8. Having the diameter, to find the ſide of a ſquare, which may be inſcribed in that circle.

If the diameter of a circle be 1, the ſide of the ſquare inſcribed will be ,7071. Therefore, as 1 : ,7071 : : 22,6 : 15,98046, the ſide inſcribed. Or if you ſquare the ſemidiameter, and double that ſquare, the ſquare root of the double ſquare will be the ſide of the ſquare inſcribed.

Problem 9. Having the circumference, to find the ſide of a ſquare which may be inſcribed.

If the circumference be 1, the ſide of the ſquare inſcribed will be ,2251. Therefore, as 1 : ,2251 : : 71 : 15,9821, the ſide of the ſquare.

Problem 10. Having the area to find the diameter.

If the area of a circle be 1, the ſquare of the diameter is 1,2732. Therefore, as 1 : 1,2732 : : 401,15 : 510,744180. the ſquare root of which is 22,599, the diameter.

Problem 11. Having the area to find the circumference.

If the area of a circle be 1, the ſquare of the circumference will be 12,56637. Therefore, as 1 : 12,56637 : : 401,15 : 5040,99932550, the ſquare root of which is 70,9999.

Problem 12. Having the area, to find the ſide of a ſquare inſcribed.

If the are of a circle be 1, the area of a ſquare inſcribed within that circle will be ,6366. Therefore, as 1 : 401,15 : : ,6366 : 255,372090, the root of which is 15,980, the ſide of the ſquare ſought.

Problem 13. Having the ſide of a ſquare, to find the diameter of the circumſcribing circle.

If the ſide of a ſquare be 1, the diameter of a circle that will circumſcribe that ſquare, will be 1,4142. Therefore, as 1 : 1,4142 : : 15,98 : 22,598916, the diameter ſought.

Problem 14. Having the ſide of a ſquare, to find the diameter of a circle equal to it.

If the ſide of a ſquare be 1, the diameter of a circle equal to it will be 1,128. Therefore, as 1 : 8,26 : : 20,0291 : 22,5928248, the diameter required.

Problem 15. Having the ſide of a ſquare, to find the circumference of a circumſcribing circle.

If the ſide of a ſquare be 1, the circumference of a circle that will encompaſs that ſquare will be 4,443. Therefore, as 1 : 4,443 : : 15,98 : 70,99914, the circumference required.

Problem 16. Having the ſide of a ſquare, to find the circumference of a circle that will be equal to it.

If the ſide of a ſquare be 1, the circumference of a circle that will be equal to it is 3,545. Then, as 1 : 3,545 :: 20,0291 : 71,0031595, the circumference.

In ſeveral of the foregoing problems, where the diameter and circumference are required, the anſwers are not exactly the ſame as the diameter and circumference of the given circle, but are ſometimes too much, and ſometimes too little, as in the two laſt problems, where the anſwers in each ſhould be 71, the one being too much, and the other too little. The reaſon of this is, the ſmall defect that happens to be in the decimal fractions, they being ſometimes too great, and ſometimes too little; yet the defect is ſo ſmall, that it is needleſs to calculate them to more exactneſs.

PART VI.

A collection of QUESTIONS *ſet down promiſcuouſly, for the greater trial of the foregoing* RULES.

1. WRITE down two millions, five hundred and two thouſand, two hundred and five.

2. What is the value of 14 barrels of ſoap, at $4\frac{1}{2}$*d. per lb.* each barrel containing 254 *lb.*? *Anſ.* £66 : 13 : 6.

3. If 100*l.* principal gain 5*l.* intereſt in 12 months—what principal will gain 20*l.* in 8 months? *Anſ.* £600.

4. What number is that from which, if the ſquare of 14 be deducted, and to the remainder the ſquare of 12 be added, the ſum will be 250? *Anſ.* 320.

5. A and B trade together; A put in 320*l.* for 5 months, B 460*l.* for 3 months, and they gained 100*l.*—what muſt each man receive?

Anſ. A £53 : 13 : $9\frac{270}{298}$. *and* B £46 : 6 : $2\frac{28}{298}$.

6. How many yards of cloth, at 17*s.* 6*d. per* yard, can I have for 13 *cwt.* 2 *qrs.* of wool, *at* 14*d. per lb.*?

Anſ. 100 *yards*, $3\frac{1}{5}$ *qrs.*

7. What number added to the cube of 21, will make the ſum equal to 113 times 147? *Anſ.* 7350.

8. If I buy 1000 ells of linen, Flemiſh, for 90*l.*—what may I ſell it at *per* ell in London, to gain 10*l.* by the whole? *Anſ.* 3*s.* 4*d. per ell.*

9. A has 648 yards of cloth, at 14*s.* *per* yard, ready money, but in barter will have 16*s.* B. has wine at 42*l.* *per* ton, ready money, the queſtion is—how much wine muſt be given for the cloth, and what is the price of a ton of wine in barter? *Anſ.* 48*l.* *the ton*; *and* 10 *ton.* 3 *hhds.* 12 *gal. of wine muſt be given for the cloth.*

10. A jeweller ſold jewels to the value of 1200*l.* for which he received in part 876 French piſtoles, at 16*s.* 6*d.* each—what ſum remains unpaid? *Anſ.* £477 : 6*s.*

11. An oilman bought 417 *cwt.* 1 *qr.* 15 *lb.* groſs weight of train oil, tare 20 *lb.* *per* 112 *lb.*—how many nett gallons were there, allowing $7\frac{1}{2}$*lb.* to a gallon? *Anſ.* 5120 *gal.*

12. I bought threeſcore pieces of Holland for three times as many pounds, and ſold them again for four times as much; but if they had coſt me as much as I ſold them for—what ſhould I have ſold them for to gain after the ſame rate? *Anſ.* £320.

13. What number taken from the ſquare of 54, will leave 19 times 46? *Anſ.* 2042.

14. If I buy a yard of cloth for 14*s.* 6*d.* and ſell it for 16*s* 9*d.*—what do I gain *per cent.*? *Anſ.* £15 : 10 : $4\frac{24}{174}$.

15. Bought 27 bags of ginger, each weighing groſs $84\frac{3}{4}$*lb.* tare $1\frac{3}{8}$*lb.* *per* bag, trett 4*lb.* *per* 104*lb.*—what do they come to at $8\frac{1}{2}$*d.* *per lb.*? *Anſ.* £76 : 13 : $3\frac{1}{2}$.

16. If $\frac{2}{3}$ of an ounce coſt $\frac{7}{8}$ of a ſhilling—what will $\frac{5}{8}$ of a lb. coſt? *Anſ.* 17*s.* 6*d.*

17. If $\frac{5}{6}$ of a gallon coſt $\frac{5}{8}$ of a £.—what will $\frac{5}{9}$ of a ton coſt? £105.

18. A young man received 210*l.* which was $\frac{2}{3}$ of his elder brother's portion; now three times the elder brother's portion was half of the father's eſtate—I demand how much the eſtate was? *Anſ.* £1890.

19. If the ſalary of an officer be 48*l.* *per annum*—what muſt he receive for 232 days? *Anſ.* £30 : 10 : $2\frac{1}{4}$.

20. A gentleman ſpends one day with another 1*l.* 7*s.* $10\frac{1}{2}$*d.* and at the year's end layeth up 340*l.*—what is his yearly income? *Anſ.* £848 : 14 : $4\frac{1}{2}$.

21. A lady's fortune conſiſted of a cabinet worth 200*l.* containing 16 drawers, each having two partitions, each of which contained 37*l.* and two crowns—pray what was her portion? *Anſ.* £1400.

22. A has 13 fother of lead to ſend abroad, each being $19\frac{1}{2}$ times 112*lb.*; B has 39 caſks of tin, each 388*lb.*—how

many ounces difference is there in the weight of theſe commodities? *Anſ.* 2:2160 *oz.*

23. A captain and 160 ſailors took a prize worth 1360*l.* of which the captain had $\frac{1}{5}$ of his ſhare, and the reſt was equally divided among the ſailors—what was each man's part? *Anſ. The captain had* 272*l. and each ſailor* £6 : 16*s.*

24. What number is that, to which if you add $7\frac{2}{3}$, the whole will be $12\frac{1}{4}$? *Anſ.* $4\frac{7}{12}$.

25. An uſurer put out 75*l.* for 12 months, and received for principal and intereſt 81*l.*—I demand at what rate *per cent* he received intereſt? *Anſ.* 8 *per cent.*

26. What will 956*l.* amount to in $7\frac{1}{2}$ years, at 5 *per cent.* ſimple intereſt? *Anſ.* £1314 : 10*s.*

27. At what rate *per cent.* will 956*l.* amount to 1314*l.* 10*s.* in $7\frac{1}{2}$ years at ſimple intereſt? *Anſ.* 5 *per cent.*

28. If for 1*l.* 4*s.* I have 1200*lb.* weight carried 36 miles—how many *lb.* weight can I have carried 24 miles for the ſame money? *Anſ.* 1800 *lb.*

29. If 8 cannons in one day ſpend 48 barrels of powder—I demand how many barrels 24 cannons will ſpend in 22 days? *Anſ.* 3168.

30. What number is that, which being multiplied by $\frac{2}{3}$, will produce $\frac{1}{4}$? *Anſ.* $\frac{3}{8}$.

31. A has 24 cows worth 72*s.* each, and B 7 horſes worth 13*l.* a piece—how much will make good the difference, in caſe they interchange their ſaid drove of cattle? *Anſ.* £4:12*s.*

32. A man dies and leaves 120*l.* to be given to three perſons, *viz.* A, B, and C; to A a ſhare unknown; B twice as much as A, and C as much as A and B—what was the ſhare of each? *Anſ.* A £20; B £40; *and* C £60.

33. A perſon dying left his widow 1780*l.* and 1250*l.* to each of his four children: he had been $25\frac{1}{2}$ years in trade, and had cleared (at an average) 126*l.* a-year—what had he to begin with? *Anſ.* £3567.

34. There is a ſum of 1000*l.* to be divided among 3 men, in ſuch manner, that if A has 3*l.* B ſhall have 5*l.* and C 8*l.*—how much muſt each man have?

Anſ. A £187 : 10*s.*; B £312 : 10*s.*; *and* C £500.

35. A piece of wainſcot is 8 ft. $6\frac{1}{2}$ in. long, and 2 ft. $9\frac{3}{4}$ in. broad—what is the ſuperficial content?

Anſ. 24 *ft.* $3^{\prime\prime}$ $4^{\prime\prime\prime}$ $6^{\prime\prime\prime\prime}$.

36. How many changes may be rung on 6 bells? *Anſ.* 720.

37. A merchant at Amſterdam is indebted to another in London

don 642*l.* and would pay it in Spaniſh guilders, at 2*s.* *per* piece —how many muſt the Engliſh merchant receive? *Anſ.* 6420.

38. If 360 men be in garriſon, and have proviſions for 6 months, but hearing of no relief at the end of 5 months —how many men muſt depart, that the proviſions may laſt ſo much longer? *Anſ.* 288 *men.*

39. The leſs of two numbers is 187, their difference 34— the ſquare of the product is required? *Anſ.* 1707920929.

40. A butcher ſends his man with 216*l.* to a fair to buy cattle; oxen at 11*l.* cows at 40*s.* colts at 1*l.* 5*s.* and hogs at 1*l.* 15*s.* *per* piece, and of each a like number—how many of each ſort did he buy? *Anſ.* 13 *of each ſort, and* 8 *over.*

41. What number added to 11$\frac{5}{7}$, will produce 36$\frac{337}{616}$? *Anſ.* 24$\frac{513}{616}$.

42. What number multiplied by $\frac{8}{7}$, will produce 11$\frac{0}{17}$. *Anſ.* 26$\frac{46}{51}$.

43. A man had 12 ſons, the youngeſt was 3 years old, and the eldeſt 58; they increaſed in arithmetical progreſſion— what was the common difference of their ages? *Anſ.* 5 *years.*

44. What is the value of 7179 hogſheads of tobacco, each weighing 13 cwt. at 2*l.* 1s. *per* cwt.? *Anſ.* £4770 : 7*s.*

45. My factor ſends me word he has bought goods to the value of 500*l.* 13*s.* 6*d.* upon my account—what will his commiſſion come to at 3$\frac{1}{2}$ *per cent.*? *Anſ.* £17 : 10 : 5. 2 *qrs.* $\frac{68}{100}$.

46. Miſs Kitty told her ſiſter Charlotte, whoſe father had before left them 13200*l.* a piece, that their grandmother, by will, had raiſed her fortune to 15000*l.* and had made her own 20000*l.*—what did the old lady leave them? *Anſ.* £8600.

47. A ſnail in getting up a May-pole only 20 feet high, was obſerved to climb 8 feet every day, but every night he came down again 4 feet—in what time, by this method, did he reach the top of the pole? *Anſ.* 4 *days.*

48. If the $\frac{1}{3}$ of 6 be 3—what will $\frac{1}{4}$ of 20 be? *Anſ.* 7$\frac{1}{2}$.

49. What is the difference between 14676, and the fourth of itſelf? *Anſ.* 11007.

50. There is in three bags the ſum of 1468*l.* *viz.* in the firſt bag 461*l.* in the ſecond 581*l.*—what was in the third bag? *Anſ.* £426.

51. What is the decimal of 3 *qrs.* 14 *lb.* of an *cwt.* *Anſ.* ,875.

52. How many *lb.* of ſugar, at 4$\frac{1}{2}$*d.* *per lb.* muſt be given in barter for 60 groſs of inkle, at 8*s.* 8*d.* *per* groſs? *Anſ.* 1386$\frac{2}{3}$.

53. If I buy yarn for 9*d.* the *lb.* and ſell it again for 3$\frac{1}{2}$*d.* *per lb.*—what is the gain *per cent.*? *Anſ.* £50.

54. A tobacconiſt would mix 20*lb.* of tobacco at 9*d.* *per lb.* with 60*lb.* at 12*d.* *per lb.* 40*lb.* at 18d. *per lb.* with 12*lb.* at 2*s.* *per lb.*—what is a *lb.* of this mixture worth? *Anſ.* 1*s.* 2¼*d* $\frac{9}{11}$.

55. What is the value of 14 barrels of ſoap, at 4½*d.* *per lb.* each barrel containing 254*lb.*? *Anſ.* £66 : 13 : 6.

56. Two perſons, A and B, owe ſeveral debts; the leſſer debt being that of A is 2173*l.* the difference is 371*l.*—what is the debt of B? *Anſ.* £2544.

57. What is the difference between twice eight and twenty and twice twenty-eight: As alſo between twice five and fifty and twice fifty-five? *Anſ.* 20 *and* 50.

58. What number taken from the ſquare of 54 will leave 19 times 46? *Anſ.* 2042.

59. A ſchoolmaſter being aſked how many ſcholars he had, ſaid, if I had as many more, half as many, and one quarter as many, I ſhould have 99—how many had he? *Anſ.* 36.

60. An ancient lady being aſked how old ſhe was, to avoid a direct anſwer, ſaid, I have 9 children, and there are 3 years between the birth of each of them; the eldeſt was born when I was 19 years old, which is now exactly the age of the youngeſt—how old was the lady? *Anſ.* 62.

61. What number is that which being added to 168 makes the ſum to be 706? *Anſ.* 538.

62. From 100*l.* borrowed, take 72*l.* paid; 'twas a virgin that lent it:—what's due to the maid? *Anſ.* £28.

63. If when wheat is 4*s.* the buſhel, the 20-penny loaf weighs 18*lb.*—what muſt the ſaid 20-penny loaf weigh, when wheat is 6*s.* the buſhel? *Anſ.* 12*lb.*

64. Whereas a noble and a mark juſt 15 yards did buy—how many ells of the ſame cloth for 50*l.* had I? *Anſ.* 600.

65. A broker bought for his principal in the year 1720, 400*l.* capital ſtock in the South Sea, at 650*l.* *per cent.* and ſold it again when it was worth but 130*l.* *per cent.*—how much was loſt in the whole? *Anſ.* £2080.

66. What number added to the 43d part of 4429, will make the ſum 240? *Anſ.* 137.

67. What number deducted from the 26th part of 2262 will leave the 87th part of the ſame? *Anſ.* 61.

68. A gentleman went to ſea at 17 years of age; 8 years after that he had a ſon born, who lived 46 years, and died before his father; after whom the father lived twice 20 years, and then died alſo—what was the age of the father when he died? *Anſ.* 111.

69. C hath candles at 6*s.* *per* dozen, ready money, but in barter will have 6*s.* 6*d.* *per* dozen; D hath cotton at 9*d.* *per lb.* ready money—I demand what price the cotton muſt be at in barter; alſo how much cotton muſt be bartered for 100 dozen of candles? *Anſ. the cotton as* $9\frac{3}{4}$*d. per lb. and* 7 *cwt.* 16*lb. of cotton muſt be given for* 100 *dozen of candles.*

70. The ſum of two numbers is 360, the leſs 114—what is their difference, product, and larger quote?

Anſ. 132 *diff.* 28044 *prod.* $2\frac{3}{19}$ *quote.*

71. A brigade of horſe, conſiſting of 384 men, is to be formed into a ſquare body, having 32 men in front—how many ranks will there be? *Anſ.* 12.

72. If a clerk's ſalary be 73*l.* a year—what is that *per* day? *Anſ.* 4*s.*

73. B hath an eſtate of 53*l.* *per annum*, and payeth 5*s.* 10*d.* to the ſubſidy—what muſt C pay, whoſe eſtate is worth 100*l.* *per annum*? *Anſ.* $11\frac{4}{53}$*s.*

74. If I buy 100 yards of ribband at 3 yards for a ſhilling, and 100 more at 2 yards for a ſhilling, and ſell it at the rate of 5 yards for 2 ſhillings—whether do I get or loſe, and how much? *Anſ. loſe* 3*s.* 4*d.*

75. What is the value of $\frac{5}{8}$ of 20*s.*? *Anſ.* 12*s.* 6*d.*

76. What number is that from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{8}$? *Anſ.* $\frac{29}{40}$.

77. My purſe and money, quoth Dick, are worth 12*s.* 8*d.* but the money is worth 7 of the purſe—pray what is the ſum therein? *Anſ.* 11*s.* 1*d.*

78. What number is that which maketh 9 to be the $\frac{2}{3}$ of it? *Anſ.* $13\frac{1}{2}$.

79. A maltſter has ſeveral ſorts of malt, one at 4*s.* 6*d.* one at 4*s.* and one at 3*s.* 6*d.* a buſhel; to mix an equal quantity of each—what muſt be the price of a buſhel? *Anſ.* 4*s.*

80. A farmer is willing to make a mixture of rye at 4*s.* a buſhel, barley at 3*s.* and oats at 2*s.*—how much muſt he take of each to ſell it at 2*s.* 6*d.* the buſhel?

Anſ. 6 *of rye,* 6 *of barley, and* 24 *of oats.*

81. If $\frac{3}{8}$ of a ſhip be worth 3740*l.*—what is the worth of the whole? *Anſ.* £9973 : 6 : 8.

82. A perſon ſaid he had 20 children, and that it happened there was a year and a half between each of their ages; his eldeſt ſon was born when he was 24 years old, and the age of his youngeſt is 21—what was the father's age? *Anſ.* $73\frac{1}{2}$ *years.*

83. Bought a caſk of wine for 62*l.* 8*s.*—how many gallons were in the ſame, when a gallon was 5*s.* 4*d.*? *Anſ.* 234.

84. B owes C 296*l.* 17*s.* but the compounds for 7*s.* 6*d.* in the pound—what muſt C receive for his debt? *Anſ.* £111:6:4$\frac{1}{2}$.

85. How many dozen of ſtockings, at 11 groats *per* pair, may I buy for 190*l.* 12*s.*? *Anſ.* 86 *doz.* 7 *pair*, $\frac{28}{44}$.

86. A ſheepfold was robbed 3 nights ſucceſſively; the firſt night half the ſheep were ſtolen, and half a ſheep more; the ſecond night half the remainder were loſt, and half a ſheep more; the laſt night they took half that were left, and half a ſheep more; by which time they were reduced to 20—how many were they at firſt? *Anſ.* 167.

87. The Spectator's club of fat people, though it conſiſted but of 15 perſons, is ſaid to weigh no leſs than 3 tons—how much at an equality was that *per* man? *Anſ.* 4 *cwt.*

88. A merry young fellow in a ſhort time got the better of $\frac{1}{5}$ of his fortune; by advice of his friends, he gave 2200*l.* for an exempt's place in the guards; his profuſion continued till he had no more than 880 guineas left, which he found by a computation was the $\frac{3}{20}$ part of his money after the commiſſion was bought—pray what was his fortune at firſt? *Anſ.* £10450.

89. B owes C 395*l.* 18*s.* but compounds the whole debt for 100*l.* 12*s.*—what is that in the pound? *Anſ.* 5*s.* 0$\frac{3}{4}$*d.* $\frac{7446}{7918}$.

90. How many dollars at 4*s.* 4*d.* each muſt be given for 360 guilders, at 2*s.* 2*d.* each? *Anſ.* 180.

91. Four men have a ſum of money to be divided amongſt them, in ſuch a manner that the firſt ſhall have $\frac{1}{3}$ of it, the ſecond $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder which is 28*l.*—what is the ſum? *Anſ.* £112.

92. What is the amount of 1000*l.* for 5$\frac{1}{2}$ years, at 4$\frac{3}{4}$ *per cent.* ſimple intereſt? *Anſ.* £1261 : 5*s.*

93. Sold goods amounting to the value of 700*l.* for two 4-months—what is the preſent worth at 5 *per cent.* ſimple intereſt? *Anſ.* £682 : 10*s.*

94. A room 30 feet long, and 18 feet wide, is to be covered with painted cloth—how many yards of $\frac{3}{4}$ wide will cover it? *Anſ.* 80 *yards.*

95. There are two numbers, the one 48, the other twice as much—what is the difference between their ſum and difference? *Anſ.* 96.

96. Hetty told her brother George, that though her fortune on her marriage took 19312*l.* out of her family, it was but $\frac{3}{5}$ of two years' rent, heaven be praiſed! of his yearly income—pray what was that? *Anſ.* £16093 : 6 : 8 *a year.*

97. There are two numbers, the one 25, the other the ſquare of 25—I demand the ſquare root of the ſum of their ſquares? *Anſ.* 625,4998.

98. Says B to C, If I had four of your ſheep, I ſhould have as many as you; and ſays C to B, If I had four of yours, I ſhould have twice as many as you—how many had each? *Anſ.* B 20, C 28.

99. B, C, and D, trading together, gained 120*l.* which is to be ſhared according to each man's ſtock; B put in 140*l.* C 300*l.* and D 160*l.*—what is each man's ſhare? *Anſ.* B £28; C £60; D £32.

100. A gentleman having 50*s.* to pay among his labourer's for a day's work, would give to every boy 6*d.* to every woman 8*d.* and to every man 16*d.* the number of boys, women, and men, were the ſame—I demand the number of each? *Anſ.* 20 *of each.*

101. There are 3 numbers, 17, 19, and 48—I demand the difference between the ſum of the ſquares of the firſt and laſt, and the cube of the middlemoſt? *Anſ.* 4266.

102. A ſtone that meaſures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep—how many ſolid feet doth it contain? *Anſ.* 41 *feet,* 3 *inches.*

103. What does the whole pay of a man of war's crew of 640 ſailors amount to for 32 months' ſervice, each man's pay being 22*s.* 6*d.* *per* month? *Anſ.* £23040.

104. If I have an eſtate of 470*l.* *per ann.* what may I expend daily, and yet lay up 130*l.* *per ann.*? *Anſ.* 18*s.* 7½*d.* $\frac{90}{365}$.

105. What number is that, which being divided by 19, the quotient will be 72? *Anſ.* 1368.

106. Reduce 13½ buſhels of coals to the fraction of a chaldron. *facit* $\frac{3}{8}$.

107. Bought 28 qrs. 2 buſhels of wheat at 4*s.* 6*d.* *per* buſhel—what does it come to? *Anſ.* £50 : 17*s.*

108. How many lbs. of coffee, at 5*s.* 9*d.* *per* lb. is equal in value to 426 lb. of tea, at 13*s.* 4*d.* *per* lb.? *Anſ.* $987\frac{57}{69}$

109. What is the value of 27 dozen, 10 lb. of candles, at 5*d.* *per* lb.? *Anſ.* £6 : 19 : 2.

110. A traveller would change 500 French crowns, at 4*s.* 6*d.* *per* crown into ſterling money, but he muſt pay a halfpenny *per* crown for change—how much muſt he receive? *Anſ.* £111 : 9 : 2.

111. There are two numbers, the one 63, and the other

$\frac{1}{2}$ as much—I demand the product of their ſquares, and the difference of their product and ſum?

Anſ. Product of their ſquares 3938240,25. *difference* 1890.

112. B and C traded together, and gained 100*l.* B put in 640*l.*; C put in ſo much that he might receive 60*l.* of the gain—I demand how much C put in? *Anſ.* £960.

113. Of what principal ſum did 20*l.* intereſt ariſe in one year, at the rate of 5 *per cent. per annum?* *Anſ.* £400.

114. Having bought 40 yards of cloth, at 8*s. per* yard, and 70 yards at 12*s.*—what is the value of both pieces? *Anſ.* £58.

115. Two men depart both from one place, the one goes north, the other ſouth; the one goes 7 miles, and the other 11 miles a-day—how far are they diſtant at the 12th day of their departure? *Anſ.* 216 *miles.*

116. In 672 Spaniſh guilders of 2*s.* each—how many French piſtoles, at 17*s.* 6*d. per* piece? *Anſ.* $76\frac{23}{35}$.

117. In 7 cheeſes, each weighing 1 cwt. 2 qrs. 5 lb.—how many allowances for ſeamen may be cut, each weighing 5 oz. 7 dr.? *Anſ.* $3563\frac{35}{87}$.

118. If 48 taken from 120 leaves 72, and 72 taken from 91 leaves 19, and 7 taken from thence leaves 12—what number is that, out of which, when you have taken 48, 72, 19, and 7, leaves 12? *Anſ.* 158.

119. A farmer ignorant in numbers, ordered 500*l.* to be divided among his 5 ſons, thus: Give A, ſays he, $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, D $\frac{1}{6}$, and E $\frac{1}{7}$ part; divide this equitably among them, according to the father's intention. *Anſ.* A £$152\frac{1392}{2754}$. B £$114\frac{1044}{2754}$; C £$91\frac{1386}{2754}$; D £$76\frac{696}{2754}$; E £$65\frac{996}{2754}$.

120 When firſt the marriage-knot was ty'd between my wiſe and me,
Her age did mine as far exceed as three times three does three;
But when 7 years, and half 7 years, we man and wiſe had been,
My age came then as near to hers as eight is to ſixteen.

Queſt. What was each of our ages when we married?

Anſ. $10\frac{1}{2}$ *years the man,* $31\frac{1}{2}$ *the woman.*

121. If 12 oxen will eat $3\frac{1}{3}$ acres of graſs in 4 weeks, and 21 oxen will eat 10 acres in 9 weeks—how many oxen will eat 24 acres in 18 weeks, the graſs being allowed to grow uniformly? (*See page* 192 *for the anſwer.*)

122. A lady was aſked her age, who replied thus:

My age, if multiplied by three,
Two ſevenths of that product tripled be,
The ſquare root of two ninths of that is four—
Now tell my age, or never ſee me more.

Anſ. 28 *years.*

A Table for finding the Intereſt of any Sum of Money for any Number of Months, Weeks, or Days, at any Rate *per cent.*

Year.	*Calend. Months*			*Weeks.*			*Days.*		
£.	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
1	0	1	8	0	0	4½	0	0	0¾
2	0	3	4	0	0	9	0	0	1¼
3	0	5	0	0	1	1¾	0	0	2
4	0	6	8	0	1	6½	0	0	2½
5	0	8	4	0	1	11	0	0	3¼
6	0	10	0	0	2	3¾	0	0	4
7	0	11	8	0	2	8¼	0	0	4½
8	0	13	4	0	3	1	0	0	5¼
9	0	15	0	0	3	5½	0	0	6
10	0	16	8	0	3	10¼	0	0	6½
20	1	13	4	0	7	8¼	0	1	1¼
30	2	10	0	0	11	6½	0	1	7¾
40	3	6	8	0	15	4½	0	2	2¼
50	4	3	4	0	19	2¾	0	2	9
60	5	0	0	1	3	1	0	3	3½
70	5	16	8	1	6	11	0	3	10
80	6	13	4	1	10	9¼	0	4	4½
90	7	10	0	1	14	7½	0	4	11¼
100	8	6	8	1	18	5½	0	5	5¾
200	16	13	4	3	16	11	0	10	11½
300	25	0	0	5	15	4½	0	16	5¼
400	33	6	8	7	13	10	1	1	11
500	41	13	4	9	12	3½	1	7	4¾
600	50	0	0	11	10	9	1	12	10½
700	58	6	8	13	9	2¾	1	18	4¼
800	66	13	4	15	7	8½	2	3	10
900	75	0	0	17	6	1¾	2	9	3¾
1000	83	6	8	19	4	7½	2	14	9½
2000	166	13	4	38	9	2¾	5	9	7
3000	250	0	0	57	13	10	8	4	4½
4000	333	6	8	76	18	5½	10	19	2
5000	416	13	4	96	3	0¾	13	13	11½
6000	500	0	0	115	7	8¼	16	8	9
7000	583	6	8	134	12	3½	19	3	6½
8000	666	13	4	153	16	11	21	18	4¼
9000	750	0	0	173	1	6½	24	13	1¾
10,000	833	6	8	192	6	1¾	27	7	11¼
20,000	1666	13	4	384	12	3½	54	15	10½
30,000	2500	0	0	576	18	5½	82	3	10

Rule. *Multiply the principal by the rate* per cent. *and the number of months, weeks, or days, which are required; cut off two figures on the right-hand ſide of the product, and collect from the table the ſeveral ſums againſt the different numbers as when added will make the number remaining. Add the ſeveral ſums together, it will give the intereſt required.*

N. B. *For every* 10 *that is cut off in months, add* 2d.; *for every* 10 *cut off in weeks, add an* ½d.; *and for every* 40 *in the days,* ¼d.

EXAMPLES.

1. What is the intereſt of 2467*l.* 10*s.* for 10 months, at 4 *per cent. per annum?*

2467 : 10
4
9870 : 0
10
987|00 : 0

900=75 : 0 : 0
80= 6 : 13 : 4
7= 0 : 11 : 8
987=82 : 5 : 0

2. What is the intereſt of 2467*l.* 10*s.* for 12 weeks, at 5 *per cent.?*

2467 : 10
5
12337 : 10
12
1480|50 : 0

1000 =19 : 4 : 7¼
400 = 7 : 13 : 10
80 = 1 : 10 : 9¼
50= 0 : 0 : 2½
1480|50=28 : 9 : 5

3. What is the intereſt of 2467*l.* 10*s.* for 50 days, at 6 *per cent.?*

2467 : 10
6
14805 : 0
50
7402|50 : 0

7000 =19 : 3 : 6½
400 = 1 : 1 : 11
2 = 0 : 0 : 1¼
50= 0 : 0 : 0¼
7402|50=20 : 5 : 7

To find what an eſtate, from 1 to 60,000*l. per annum*, will come to for 1 day.

RULE. Collect the annual rent or income from the table of one year, againſt which take the ſeveral ſums for one day, add them together, it will give the anſwer.

An eſtate of 376*l. per annum*—what is that *per* day?

300=0 : 16 : 5½
70=0 : 3 : 10
6=0 : 0 : 4
376=1 : 0 : 7½

To find the amount of any income, ſalary, or ſervants' wages for any number of months, weeks, or days.

RULE. Multiply the yearly income, or ſalary, by the number of months, weeks, or days, and collect the product from the table.

What will 270*l.* *per annum* come to for 11 months, for 3 weeks, and for 6 days?

For 11 months.

270 2000=166 : 13 : 4
11 900= 75 : 0 : 0
70= 5 : 16 : 8

2970 =247 : 10 : 0

For 3 weeks.

270 800=15 : 7 : 8¼
3 10= 0 : 3 : 10

810 =15 : 11 : 6¼

For 6 days.

270 1000=2 : 14 : 9½
6 600=1 : 12 : 10½
20=0 : 1 : 1

1620 =4 : 8 : 9

For the whole time.

247 : 10 : 0
15 : 11 : 6¼
5 : 8 : 9

267 : 10 : 3¼

A TABLE, ſhewing the number of days from any day in the month to the ſame day in any other month through the year.

	To	*Jan.*	*Feb.*	*Mar.*	*April*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
From	*Jan.*	365	31	59	90	120	151	181	212	243	273	304	334
	Feb.	334	365	28	59	89	120	150	181	212	242	273	303
	Mar.	306	337	365	31	61	92	122	153	184	214	245	275
	April	275	306	334	365	30	61	91	122	153	183	214	244
	May	245	276	304	335	365	31	61	92	123	153	184	218
	June	214	245	273	304	334	365	30	61	91	122	153	183
	July	184	215	243	274	304	335	365	31	62	92	123	153
	Aug.	153	184	212	243	273	304	334	365	31	61	92	122
	Sep.	122	153	181	212	242	273	303	334	365	30	61	91
	Oct.	92	123	151	182	212	243	273	304	335	365	31	61
	Nov.	61	92	120	151	181	212	243	273	304	334	365	30
	Dec.	31	62	90	121	151	182	212	243	274	304	335	365

Anſwer to Queſtion 121, *page* 189.

If 12 oxen eat up 3⅓ acres of graſs in 4 weeks, then 21 ox. will eat up 13⅛ ac. in 9 wk.; but as 21 ox. eat up only 10 ac. in that time, therefore in 5 wk. 10 ac. will become by the growth of the graſs equal to 13⅛, and conſequently 3⅛ is the increaſe in that time: hence, as 5 wk. : 3⅛ ac. : : 14 wk. : 8¾ ac. the increaſe of 14 wk. upon 10 ac. and by proportion 21 acres will be the increaſe of 24 in that time, which added to 24, give 45 for the whole quantity of graſs which is to feed a certain number of oxen 18 wk.; but in order to find this number ſay, If 3⅛ ac. ſerve 12 ox.—what will 45 ac.? *Anſ.* 162. And laſtly, If 4 wk. : 162 ox. : : 18 wk. : 36, which is the number of ox. ſought.

THE END.